INTERNATIONAL

PROJECTIONIST

iP

JANUARY 1941

VOLUME 16 • NUMBER 1

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TO PROJECTIONISTS!

Visitron cells are available for every type of sound projection equipment. Theatre supply dealers can advise the correct cell for your equipment. Buy from your supply dealer. If you wish to have your old cells tested without charge, write to G-M Laboratories, Inc., for instructions for shipping. Information furnished promptly.

THE TECHNICAL SIDE OF
RCA FANTASOUND
as used in Walt Disney's
FANTASIA

The RCA Fantasound equipment which reproduces sound in Walt Disney's "Fantasia" is the result of close collaboration between RCA and Disney engineers. Fantasound produces the effect of "acoustic perspective" together with volume ranges not previously possible with theatre sound equipment.

During the production of "Fantasia" *many recording channels* were used, with each channel controlled individually to record the desired effect from certain sections of the Philadelphia Symphony Orchestra, under the direction of Leopold Stokowski. These many recordings were re-recorded, under careful control, on three sound tracks.

In sound reproduction RCA Fantasound comprises three separate reproducing systems. Each receives its motivating signal from one of three individual sound tracks. These tracks are recorded on a single film, as illustrated, and this film passes through a multi-track soundhead which operates in synchronism with the picture heads. In order to provide for recording levels great enough for the required power output, each track is double the width of standard sound track, and amplifiers and associated loudspeaker equipment have been enlarged proportionately in power handling capacity.

The fourth track, at the bottom of the film illustration, is called the "control track." This track operates automatically to control the input signal level to each of the three sound reproducing channels. This is accomplished by ingenious use of a variable gain amplifier and filter for each channel. Three fixed frequencies are recorded on the control track, with each frequency suppressed or expanded as desired when recorded on the track. These three frequencies, feeding into the filter in each reproducing channel, are segregated by the filters, each filter being tuned to pass one frequency and reject the other two. The variable gain amplifiers then respond to the frequency amplitude variations and expand or compress the recorded sound in their respective channels.

Three separate systems of loudspeakers are employed backstage together with auxiliary speakers located about the auditorium. With power to these speaker systems individually and automatically controlled, sound effects of extraordinary realism are produced in synchronism with the portrayed screen action.

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RCA THEATRE SERVICE

RCA MANUFACTURING COMPANY, INC., CAMDEN, N. J.

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

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Monthly Chat

REPORTS from the field indicating considerable difficulty in obtaining prompt shipment of orders for the new coated lenses, as reflected in a couple items in this corner, have been challenged by Bausch & Lomb Optical Co. A statement by Mr. I. L. Nixon of B. & L., published elsewhere herein, shows that the oldest order for such lenses now on file does not exceed thirty days. We stand corrected on this point, and we know that the field will welcome this good news.

While on this topic, however, we might point out that B. & L. is about the only large-scale manufacturer of vital projection needs that is able to make such prompt delivery. Practically all the larger plants are busy on national defense equipment, the list being headed by such notable concerns as International Projector Corp. and RCA. Future needs should be anticipated by the placement of orders now, because it is certain that the defense program will be accelerated rather than tapered off.

• • •

There is no reason for the jittery attitude displayed by some projectionists anent the announced control-track recordings. It will be some time before these systems are introduced generally, because up to now not even the recording standards have been agreed upon. Moreover, the craft is handling very well the various "Fantasia" showings, which utilize separate heads for picture and sound. Control-track recordings, when available, will utilize only the single conventional film strip.

Meanwhile, it would be well to reiterate that any modern sound equipment can be bought and installed now without the least concern regarding its complete adaptability to the new recordings—when the latter start to come through.

• • •

Anybody who thinks that the television people have been standing still while the battle over standards raged between the F.C.C. on one side and the equipment manufacturers on the other, would have such illusions dispelled—and how!—by viewing RCA's theatre television show. Images picked up 100 miles distant are transmitted by radio relays to the theatre and there projected a distance of 60 feet onto a 15 by 20-foot screen! And with good lighting and detail, too. Complete details inside.

With the facilities now at its disposal, RCA could do a whale of a job in blanketing the entire Metropolitan N.Y. area, including portions of Connecticut and New Jersey, and, with the aid of the G. E. station in Schenectady, much of N. Y. State and some of Pennsylvania. This being so, can radio network television for the nation be far removed? Emphatically not.

INTERNATIONAL PROJECTIONIST

VOLUME XVI JANUARY 1941 NUMBER 1

Modern Microphone Types, Structure and Operating Technique

By *R. J. KOWALSKI*
PHOTOPHONE SERVICE DIVISION
RCA MANUFACTURING CO., INC.

THE increased use of sound reenforcing systems in theatres in recent years has created considerable interest among projectionists in microphones and their application. Manufacturers now offer a wide variety of styles and types of microphones to fit all installations. However, each type has certain physical and performance characteristics which make its selection advisable for certain limited applications. It is necessary to understand these characteristics thoroughly and to have a good knowledge of the conditions under which the unit is to operate before selecting a microphone.

After making a survey of a large number of installations about the country, an outstanding sound engineer reported that 80% of all complaints encountered could be traced to improper choice of microphones or to improper application, rather than to material defects.

Microphones may be grouped into three general classifications: these are the pressure-operated group which includes the carbon, dynamic, and crystal microphones; the velocity-operated group which includes all of the so-called "ribbon" microphones; and, finally, the microphone which incorporates both pressure and velocity principles, the unidirectional microphone.

The pressure type, as the name implies, operates on the variations in air pressure set up by the sound waves in the vicinity of the microphone. Sound has been defined as a compressional wave-motion set up by a vibrating body in a suitable medium. When a speaker cone is set in motion by a sound signal from the amplifier and moves forward, the molecules of air in front of the cone are compressed, forming a "high-pressure" wave. This moves out away from the speaker at the speed of sound in that particular medium. Then, when the cone moves back, the air in front of the speaker is rarified, creating a "low-pressure" wave.

FIGURE 1

The "high-pressure" wave and the "low-pressure" wave constitute a complete cycle, which is repeated for every vibration of the speaker cone. As these variations in air prèssure strike the diaphragm of the pressure-type microphone, they cause this diaphragm to move in and out and in so doing activate the signal generating device.

The Carbon Microphone

In the carbon microphone, the diaphragm is fastened to a piston-like disc which fits into one end of a closed cylinder. This cylinder is full of tiny granules of carbon. The variations in air pressure caused by sound waves cause the piston to move back and forth, compressing or releasing the carbon granules. Since the resistance of the granules varies with the degree to which they are compressed, the microphone acts like a variable resistor.

If a battery be connected in series with the microphone, a fluctuating current will be set up in the circuit due to the variations in resistance. These fluctuations in current constitute our signal current,

FIGURE 2

which may be amplified and eventually applied to the system loudspeakers. The carbon microphone has rather poor fidelity, hence is rarely used for sound re-enforcing or broadcast work. However, it still is the most practical type of microphone for telephone service.

The Dynamic Microphone

The dynamic microphone has a coil of wire fastened to the diaphragm which is placed in the field of a strong permanent magnet. As the diaphragm moves back and forth, the conductors of the coil cut the magnetic lines of force and the signal voltage is generated in them.

Fig. 1 shows a picture of the new RCA aeropressure microphone which is of this type. This unit is rugged and dependable and is particularly suited for close talking applications. Its overall frequency response is good but it is not as uniform as that of the velocity microphone nor is its pickup angle as great as that of the latter unit. A line transformer is located in the streamlined housing which makes it possible to operate this unit satisfactorily as far as 1000 feet from the amplifier.

The Crystal Microphone

The third type of pressure microphone, the crystal microphone, consists merely of a Rochelle Salt Crystal with contacts fastened to the two flat surfaces and a means of coupling the crystal to the pressure diaphragm. When a Rochelle Salt Crystal is distorted, a voltage is developed between its two faces. The polarity of this voltage is dependent upon the direction of distortion, and the intensity of the voltage is dependent upon the extent of the distortion. Hence, when the changes in air pressure applied to the diaphragm by sound waves cause the crystal to vibrate, a signal voltage is developed between the two surfaces.

The Velocity Microphone

Instead of relying on changes in pressure, the velocity microphone is actuated by the movement of the air molecules in the sound wave, hence the name. This microphone consists of a very light metallic ribbon suspended between the poles of a strong permanent magnet. As sound waves strike the ribbon both at the front and the back, it is set in motion in accordance with the motion of the air particles. Since this metallic ribbon is a conductor moving in a magnetic field, a voltage is generated in it which is proportional to the sound intensity.

Because the only mechanical moving part of this microphone, the ribbon, is very light, it follows very accurately the motion of the air particles and hence produces a very accurate electrical reproduction of the sound waves. This microphone and the unidirectional microphone have no equals for fidelity reproduction. An RCA velocity microphone is shown in Fig. 2.

While most pressure-type microphones pick up sound equally well from all directions, the velocity microphone only picks up sound from in front and from in back. The fact that the two sides are not sensitive is beneficial, making it possible to shift the position of the microphone until minimum acoustic energy is picked up from the auditorium loudspeakers and hence acoustic feed-back can be held to a minimum. The directional characteristics of the velocity microphone are illustrated in Fig. 3.

The RCA unidirectional microphone, shown in Fig. 4, has a directional pickup pattern wholly different from that of any other microphone. It combines the principles of pressure and velocity operation, and it possesses, to a surprising degree, the best features of each and overcomes the disadvantages inherent in both.

This microphone contains a thin metallic ribbon suspended between the poles of a permanent magnet just as in the velocity microphone. However, in this case, the ribbon is rigidly clamped in the center as well as at top and bottom. The lower half of the microphone is open front and back and operates as a standard velocity microphone. It has a "figure 8" response pattern typical for such units.

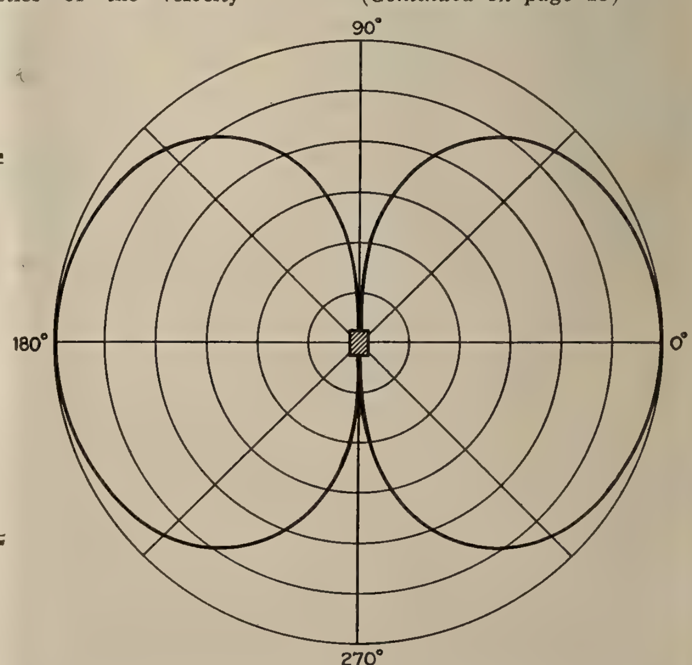
The rear of the top half of the ribbon is enclosed by a device that presents an acoustic impedance to that part of the ribbon. This impedance is obtained by an ingenious labyrinth which is loosely filled with sound-absorbing material which provides the desired damping. Since the rear of the top half of the ribbon is enclosed and thoroughly damped, this portion of the microphone functions as an efficient pressure-operated unit and has a response pattern typical of such microphones.

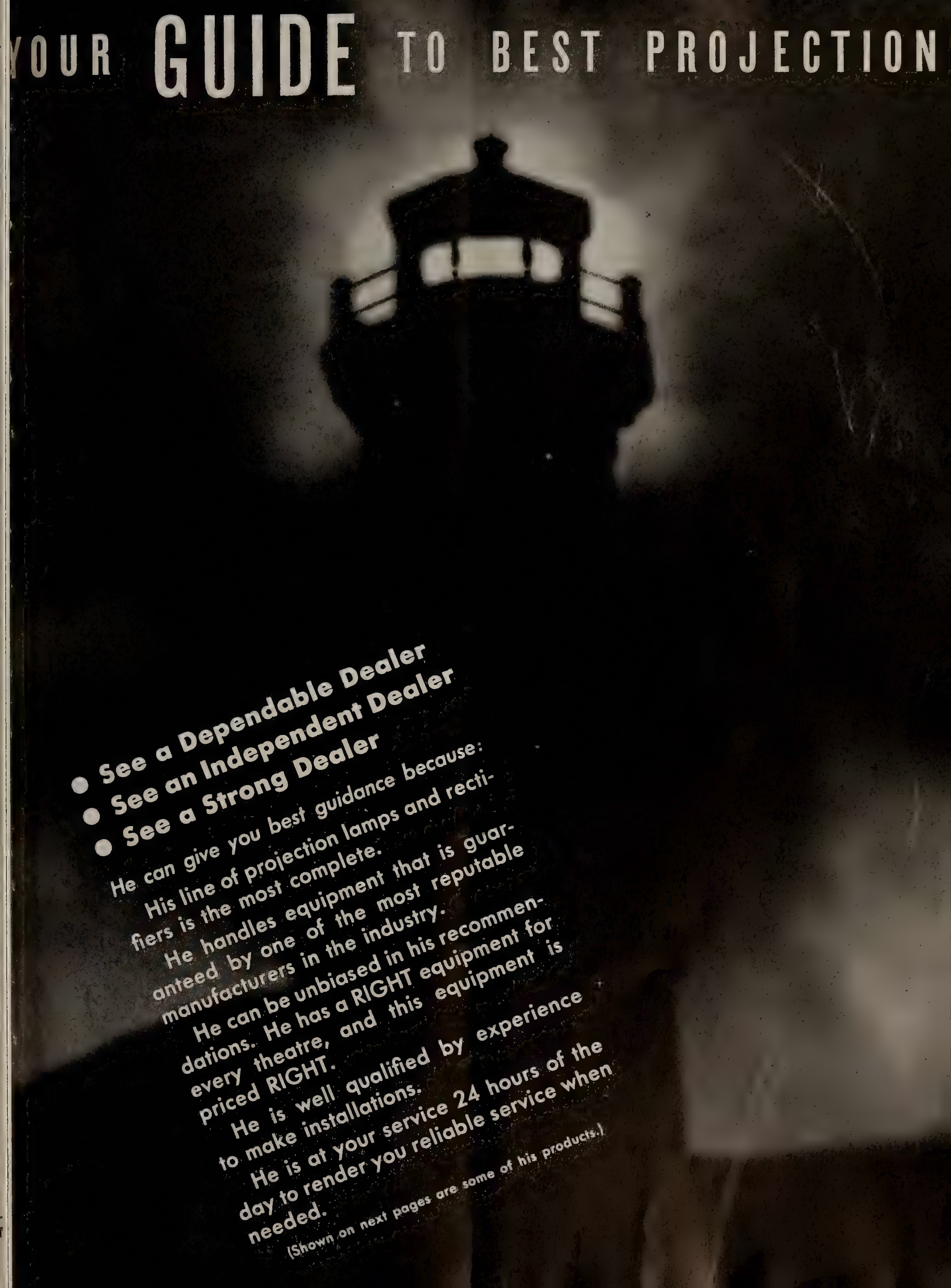
The ends of the ribbon are connected to the primary of a line transformer. Since the vibrations of each half of the ribbon are in exact accordance with the sound vibrations, and since they occur within a magnetic field, alternating electric potentials will be generated simultaneously in both halves of the ribbon. These potentials will be additive or subtractive, depending upon the location of the sound source. Actually, they are

(*Continued on page* 13)

FIGURE 3

Directional characteristics of RCA velocity microphone

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A doubling in light over the low intensity was made possible at an increased combined current and carbon cost of less than 2c per hour.

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Designed to project a volume of light even beyon
the normal requirements of theatres employing large
screens of non-reflective surface, screens that require
a tremendous increase in light value to maintain
satisfactory level of illumination.

FIGURE 4

additive for sound waves approaching from the front, and subtractive for sound waves approaching from the rear. As a result, we have a microphone which has practically no pickup of sounds from the rear and a wide angle of pickup from the front. An illustrated explanation appears in Fig. 5.

Case "A" shows the condition which exists when the train of sound waves arrives from some point in front of the microphone. Ribbons "A" and "B" will be moved in the same direction at any given instant. The voltages induced in the two ribbons will then have the same phase relation and hence will be additive. Thus the primary voltage will be proportional to E_1 and E_2.

Case "B" shows that when the train of sound waves arrives from the rear, ribbon "B" operates in the normal manner and its movement at the instant we have under consideration is in the same direction as the travel of the sound waves. At the same instant, ribbon "A" will be deflected in the opposite direction by the increasing pressure on its front in the same manner as the diaphragm of any other pressure-operated microphone would be deflected.

The resulting directional pattern resembles a cardioid and results from the combination of the "figure 8" pattern of a velocity microphone and the circular pattern of a pressure-operated microphone, as shown in the lower half of this figure. The forward lobe of the "figure 8" adds to the circular pattern, while the rear lobe, which is 180 degrees out of phase, subtracts from the circular pattern, giving the resultant cardioid.

Such a microphone has many advantages, particularly when used for pickup in large theatres or studios where reflected sound or audience noises reaching the rear of the microphone might otherwise constitute serious problems. The wide pickup angle makes it ideal for picking up a large spread-out group like an orchestra.

The latest microphones of this type now have a selector switch which connects the line transformer to either half of the ribbon or to both halves together. In this way, by merely throwing a switch, the unit becomes a pressure, velocity, or unidirectional microphone.

Appended hereto are a few simple rules to be followed in using a microphone:

1. There is no definite rule on how far from a microphone a person should stand. The average individual should stand at least 18 inches away and talk as though he were addressing someone 4 feet away.

2. If you get too close to a ribbon-type microphone, your voice will become boomy. There will also be too many mouth noises which are amplified.

3. If you must talk loudly or overemphasize, step back from the microphone or turn away slightly.

4. Place one foot in advance of the other in order to permit a gentle and easy rocking motion toward and away from the microphone.

5. Always inhale quietly through the nostrils.

6. Never breathe directly into a microphone, unless you desire to create a windstorm "sound effect."

7. If you must read from a script, don't rattle the paper.

8. Don't permit the paper to touch the microphone.

9. Don't bump into or handle the microphone in any way.

10. Don't overemphasize words ending in *t*, *k*, or *p*. They cause "crackles."

11. Remember, you cannot depend on gestures or facial expressions as an aid in expressing thoughts and attitudes. The voice must do the whole job.

12. When singing or playing a musical instrument, do not beat time with your foot.

13. Care should be taken in placing the microphone. Satisfactory performance is more important than appearance.

14. Naturalness is the most important factor. Try to be natural.

CENSUS SHOWS 15,115 HOUSES

In a preliminary summary of the 16th U. S. Census, the Dept. of Commerce's Bureau of Census reports that film theatres, including those using vaudeville, constitute 15,115 of the 44,917 places of amusement in the country, or 33.7 per cent. In 1935, there were 12,024 film theatres.

Total volume of business of the 15,115 theatres during 1939 was $673,045,000, or 67.4 per cent of the amusement field's aggregate of $998,079,000. The 1935 film theatre receipts total was $508,196,000.

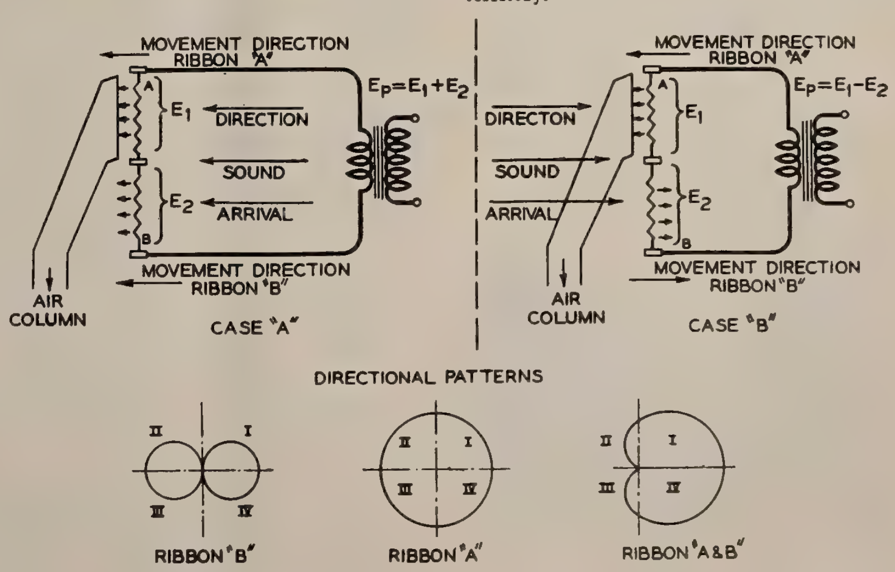
The film theatres together employed 125,684 persons, or 56.2 per cent of the average yearly total employment of 223,729 in the amusement industry. Full-time employes numbered 103,879; part-time, 21,805. Total number of employes in 1935 was 93,052.

CIO CONCEDES IA PRIORITY

Unionization of theatre employes in Scranton, Pa., area will be solely within the jurisdiction of the IATSE under terms of an agreement reached recently by A. F. of L. and CIO officials. This fact came to light this week when at a judicial hearing a motion was made to make permanent the temporary injunction restraining A. F. of L. members from picketing in front of the Bull's Head Theatre.

The CIO has revoked its contract with the theatre, which move brings to an end a long dispute between the two unions in this territory.

FIGURE 5



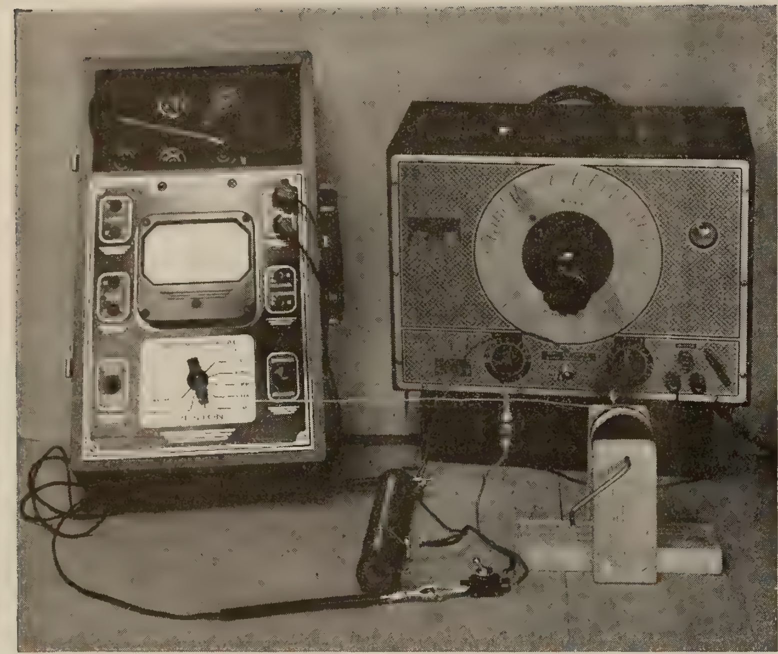


FIGURE 1

Resonant Circuits

By *L. P. WORK*

MEMBER, I.A.T.S.E. LOCAL UNION 661

THE phenomena of electrical resonance and the use of combined circuits of L, inductance; C, capacitance; and R, resistance, is common in the newer theatre equipments. Radio transmitters and receivers of all types are dependent for their operation upon the use of these circuits; without them (excluding piezo-electric and magneto-constriction effects which are forms of electro-mechanical resonance) we could not have the highly selective sets which are in everyday use.

There are two kinds of electrical resonance: the series circuit called current resonant in Fig. 3A, of which the Western Electric 7A scratch filter was a common example, and the parallel circuit, Fig. 3B, called voltage resonant, which is used in small sets to reject 120-cycle hum due to A.C. exciter lamp operation. Both depend for their operation on the storage effect of the condenser and the "flywheel" effect of the inductance.

A thorough understanding of these two simple circuits should be had because they constitute the basis for all resonant equalization, no matter how complex the final circuit may be.

FIGURE 2

When a coil and a condenser are connected in series, as in Fig. 3A, and A.C. of varying frequency (voice currents for instance) is impressed across the combination, one frequency will be found where the line current will be large, while at other frequencies it will be very small. The frequency of large line current is determined by the size, in combination of the condenser and the coil, and follows the general formula:

$$\text{Resonant frequency—fr} = \frac{1}{6.28\sqrt{L\ (\text{henries}) \times C\ (\text{farads})}}, \text{ or } \frac{159{,}000}{\sqrt{L\ (\text{microhenries}) \times C\ (\text{microfarads})}}.$$

Below resonance the current is limited by the reactance of the condenser and is leading in phase. At resonance the reactive voltages across the condenser and the coil are 180° out of phase, thus cancelling and allowing high current to flow, impeded only by the coil resistance which is purposely kept low. A voltage Q times the line voltage appears across the coil and across the condenser at resonance, so condensers of relatively high voltage rating must be used to prevent breakdown. For instance, a signal of 10 volts applied across a series combination having a Q of 40 will produce 400 volts across the condenser at resonance; the coil will offer no trouble along this line.

The Choice of Size

Theoretically, any size of coil or condenser can be used, the only constant being the LC product, which is:

$$LC = \frac{1}{(6.28\ f_r)^2}; \text{ then } L = \frac{1}{(6.28\ f_r)^2 C}, \text{ and } C = \frac{1}{(6.28\ f_r)^2 L}$$

A large coil will resonate with a small capacity, and a large capacity with a small coil, at the same frequency provided the product of the inductance and the capacity are the same; but from a constructional standpoint there are obvious limitations in the sizes chosen.

After working out an LC product for a certain frequency, it is very puzzling to know what practical size of L and C to use under the aforestated formulas. To illustrate: the LC product for resonance at 120 cycles is .00000176; then, making L equal to C by extracting the square root of this figure gives L = .001327 henries, or 1.33 millihenries, and C = .001327 farads, or 1330 microfarads.

These two values will resonate at 120 cycles, but the capacity is out of the question, so as a general rule for prac-

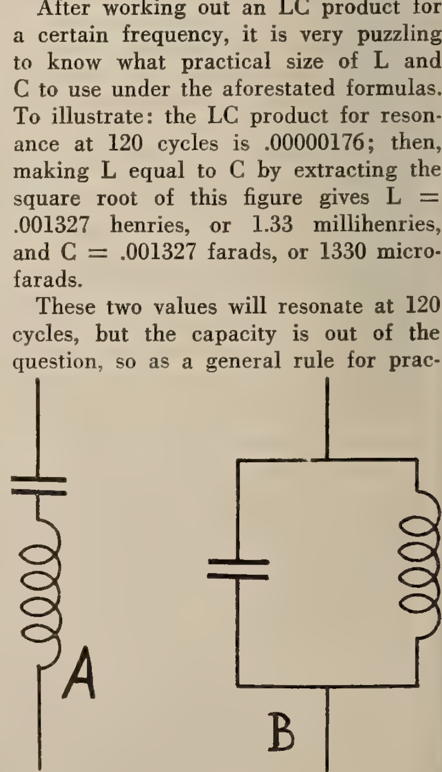


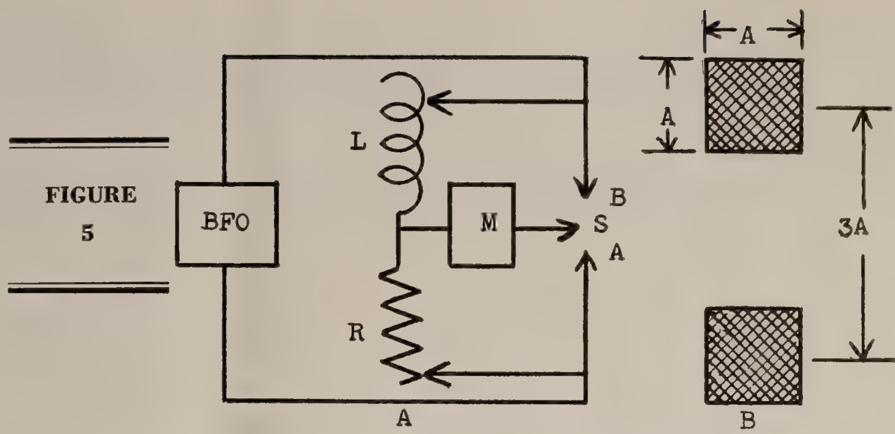
FIGURE 3

tical sizes, shift the decimal point three places to the right for inductance and three places to the left for capacity; then proceed on that basis. This case gives 1.33 henries and 1.33 microfarads for 120 cycles, which are entirely practical; yet values of 3 to 1 either side of this may be used if the coil has a satisfactory Q and the LC product is kept the same.

When selecting condensers for the combination use only paper or mica, and do not lose sight of the fact that they may be off 10% or more from their marked size with the usual commercial tolerances.

The way in which impedance and line current vary with the impressed frequency is shown in Fig. 4, wherein the current and impedance are represented on the vertical axis and the varying frequency on the horizontal axis. The slope or sharpness of the curve near resonance is set by a "merit" factor called Q, which is the ratio of the reactance to the resistance, $\frac{6.28 f_r L}{R}$ for the coil, and $\frac{1}{R\,(6.28 f_r C)}$ for the condenser.

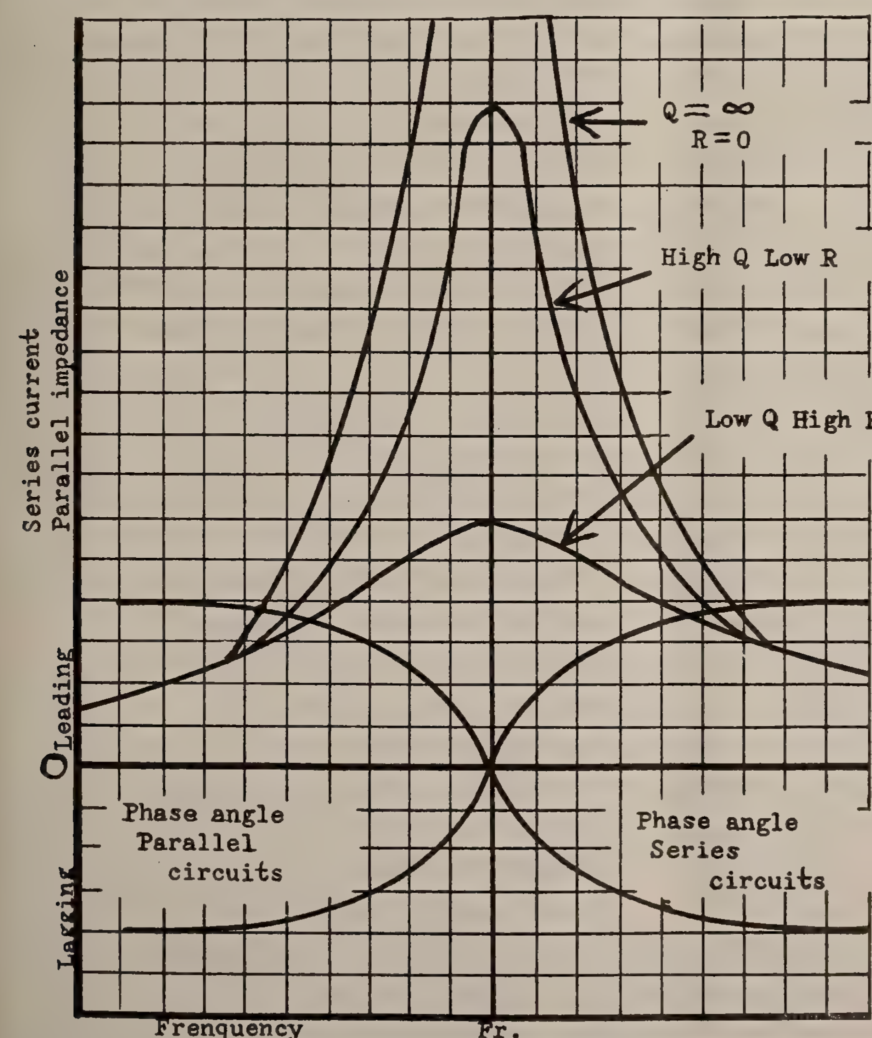
FIGURE 5



A high Q gives sharpness to the curve which is generally desired, thus we must use coils having high inductance in comparison with their D.C. resistance. The Q of a condenser is always so high that the coil Q is the ruling factor in the resonance curve. Air-core coils used in radio frequency have Q's running from 100 to 300; while in the audio frequency range a Q of 40 or 50 is difficult to obtain without the use of iron. Therefore large coils of relatively heavy copper are needed to give a satisfactory Q and keep down resistance losses when used in output circuits of low impedance, such as for dividing networks, etc.

In Fig. 2 the large coils for such use were wound with No. 16 cotton enamel wire, having an inductance of 100 and 167 millihenries with a Q of 40; the small coils wound with No. 24 are 1.7 and 7.6 millihenries for use in a high-frequency cut-off filter in low-level input circuits. These coils were homemade and measured by a comparison method described hereinafter.

FIGURE 4



Parallel Circuits

For parallel resonance (also termed a "tank circuit") as shown in Fig. 3B, the opposite effect is had. At resonance the impedance is extremely high, the current in the line low; and as the applied frequency departs from resonance the impedance drops, while the line current increases at a rate which again depends on the Q of the circuit.

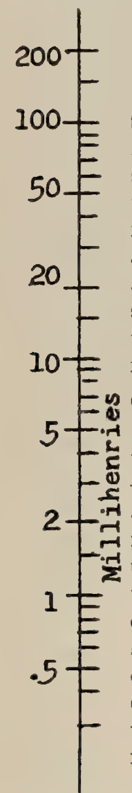
Below resonance the current flows through the coil and is lagging because the inductive reactance of the coil predominates; at resonance the impedance is purely resistive and depends on the coil resistance; above resonance the line current flows through the condenser and is leading. The same calculations are used in determining the size of L and C for parallel circuits as in series circuits.

Construction of Coils

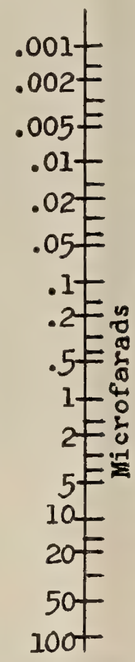
Maximum inductance for a given amount of wire in a multi-layer solenoid is obtained when the proportions are as indicated in Fig. 5B; however, these need not be exact and considerable variation may be tolerated, as long as one has room on the form. There are complicated formulas for determining the number of turns and the final size of the coil for the inductance wanted, but they require special tables of constants which are too unwieldy for occasional use, so the average experimenter estimates form size with what he has seen previously and then winds by trial.

The small spools shown will wind about 10 mh. of No. 24 single cotton,

and the large ones about 200 mh. of No. 16. One thing to remember in winding is the fact that the inductance increases roughly with the square of the turns, hence a form may be fairly well filled before any appreciable inductance is noted. For example, the inductance of the largest coil in Fig. 2 jumped from 100 to 167 mh. in the last two layers of wire.

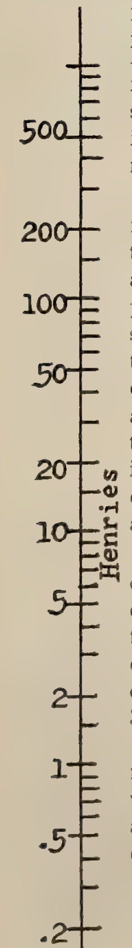


Magnetic materials should be avoided in the forms: good dry wood for the larger sizes and fiber for the smaller sizes is satisfactory, which may be held together with brass machine screws. It is not necessary to wind smoothly, although the greatest amount of inductance per wire used will be had with smooth winding; bank winding or other types of low-distributed capacity windings are not needed.

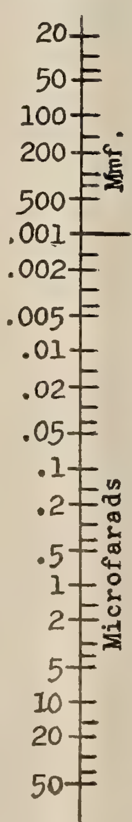


Calibration of Coils

Measurement on an A.C. bridge is the best method of checking inductance—a bridge which balances the unknown against a standard inductance, either fixed or variable. An A.C. bridge for use in the audio range is simple enough to build, and not expensive—until it comes to buying the variable inductance standards. This purchase will deplete one's pocketbook, because one is not enough: several are needed to keep the working ratios of the bridge arms within reason.



The best answer to the problem within reach of one's pocketbook, the writer has found, is the RCA Universal A.C. Bridge. Many readings taken with this instrument against other standard instruments of inductance and capacitance in the range used for audio frequency modification were right on the nose.



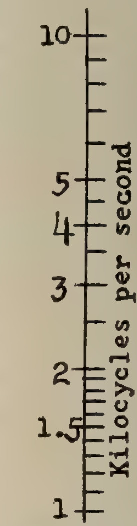
Readings of less accuracy but satisfactory for this work can be made with the circuit of Fig. 5A in which the voltage-drop across an unknown coil is compared with the drop across a known resistance having negligible inductance in the audio range, either the wire-wound or carbon radio controls. Obviously, the arrangement measures impedance rather than the inductive reactance alone, but is in error only by the amount of the copper resistance of the coil and the accuracy of the test frequency.

The two small coils of Fig. 2 were calibrated by this method, and subsequently readings on the same coils were taken by the Illinois Testing Laboratories of Chicago. With five taps on each coil, the average accuracy was about 3.5% per tap.

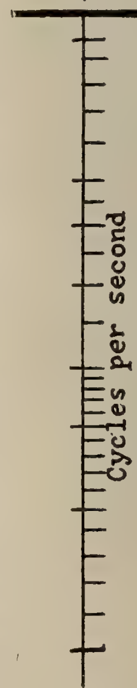
Meter M should be a high-sensitivity rectifier-voltmeter, or, better still, a vacuum-tube voltmeter, variable resistance R of a suitable value to match the quantity 6.28 f_rL desired. Switch S may be anything in the junk box. The beat-frequency oscillator need not be a commercial item: it may be a home-made, fixed-frequency oscillator of radio magazine vintage. This can be set accurately at 1000 cycles by adjusting to zero audible beat, the 1000-cycle note being maintained with a precision of better than one part in ten million by means of standard frequency broadcasts by the National Bureau of Standards station WWV on 5000 KC. This station was recently destroyed by fire (Nov. 6), but is now being rebuilt and will resume the standard frequency broadcasts.

To obtain a satisfactory meter indication, small inductances of 5 mh. or less should be measured with a higher frequency, 4000 cycles, which can be spotted on a home-made oscillator by tuning to the second octave above the 1000 KC standard signal.

Some attention must be paid to the proper loading of the oscillator by inserting a resistor of from 200 to 500 ohms in series with an oscillator of low impedance output, or by using a matching transformer when the impedance across L and R together is less than 500 ohms. This is necessary because most oscillators will deliver a sine wave at and above their rated impedance, but loading with a lesser impedance results in distortion.



Determine the ohms resistance to balance against by the formula R = 6.28 × test frequency × L (stated as a decimal) and set resistance R at that value with an ohmmeter. Then, with the oscillator at the frequency selected in the formula, choose any convenient reading on the meter with the switch in A position, which reads the drop across R, and continue winding until the reading is the same in both switch positions regardless of the actual reading, which is merely a balance indicator.



A convenient means of winding and measuring obtains by mounting the form on a threaded brass rod (5/32" rod threaded 8-32 for small coils, and ¼" rod threaded 14-20 for larger coils), one end of which may be bent to form a crank, and spring clips used to make temporary test connections to the wire which has been scraped at the trial points.

When the coil is completed, the crank may be cut off and the threaded part used as a mounting stud, thus avoiding repeated removal of the coil from the winding rig for measurements. Outside of the fact that they are straight-line devices, this is the chief argument for using solenoids experimentally, because a coil wound for use on any magnetic core must be removed and the core assembled on the coil for every measurement, which is an endless task.

The Use of Charts

The matched L-C-F charts printed herewith cover the audio range nicely and afford a time-saving device in the selection of constants. When any two are known, the third may be read by placing a straight-edge across the other two; thus, one can quickly determine any one unknown with sufficient accuracy for use in simple resonant circuits. In using these charts the three points must all be on one side of the center dividing line; they are actually the suitable range from two different charts placed together.

New Treatment for the Prevention of Film Abrasion and Oil Mottle†

By *R. H. TALBOT*

EASTMAN KODAK COMPANY

GENERAL film appearance and picture quality have long been major problems with the motion picture industry. Of the numerous factors influencing screen quality, this paper will deal with two, namely, film abrasion and oil mottle.

The former of these, film abrasion, has been the object of much research leading to a large number of patented processes, some of which are in use in the trade. These processes, in general, leave something to be desired, either in effectiveness or in price, frequently in both. They depend for their effectiveness on the principle that the treated surfaces will be more resistant to abrasion than those not similarly treated. Whereas this may be true in some cases, the fact remains that no practical film surface has been found which will resist abrasion indefinitely. Therefore, when these treated surfaces become abraded, they present the same problem as do any other scratched films.

Protection from Abrasion

Experiments have been conducted in this laboratory and in the field with a new type of film treatment based on a new principle. The aim has been to devise a lacquer which can be applied easily and removed easily. This lacquer, when applied to both sides of the film, becomes scratched just as the film surfaces would have been scratched by any sharp points coming in contact with it. If the thickness is correct, however, normal scratches do not go through the lacquer layer into the film. Therefore, on removal and renewal of the lacquer, the film is found to be in as good condition as when new.

As for the lacquer itself, it was necessary that it fulfill certain definite requirements. These requirements were:

(1) Its manner of application must be simple, requiring practically no special equipment.

(2) Its rate of application must be comparable to average processing speeds.

(3) It must be easily removable without the aid of solvents or special equipment.

(4) It should be applicable to both sides of nitrate and safety films without any deleterious effect upon physical properties, such as curl, flexibility, moisture absorption, etc.

(5) It must dry rapidly to give a smooth coating of glossy appearance. The reason why a glossy surface is essential will be discussed later.

(6) It should make the films fingerprint-proof.

The Eastman Protective Film Lacquer admirably fulfills all the laboratory requirements enumerated. Comparison of coated and uncoated films both immediately after coating and after service in the field has shown that there has been no noticeable change in physical properties. In addition, fingerprints may be removed completely from the coated film by gentle wiping.

Films treated with this lacquer will be protected against all ordinary cinch marks and against the normal scratches found on most films which have been in service in the trade. It would be ridiculous, of course, to pretend that any lacquer of a thickness of 0.0001 inch could not be scratched through, if conditions are severe enough. Our experience, however, indicates that such scratches seldom occur in practice.

There is one other point in regard to this scratch-protective layer that should be mentioned. It has been pointed out that our aim was to apply a lacquer which would bear the scratches which would normally be found on the film. The question naturally arises, "To what extent does the coating itself become scratched? Does it scratch more or less readily than normal film surfaces?"

Protection from Oil Mottle

This question can be answered at the present time only in the following way. Laboratory comparisons have indicated that the coated films have approximately the same scratch resistance as untreated films. However, without a single exception, the experience with these coated films in the field has indicated that they are definitely more resistant to abrasion than the uncoated checks. The ultimate answer to this question must be deferred until more practical information has been accumulated.

To this point we have been concerned with film abrasion. We will now consider the closely allied subject of oil mottle or, in other words, the continual flicker on the screen due to oil spots on the film. In the course of our study, it soon became apparent that flicker due to oil on the film was more detrimental to screen quality than was the occasional scratch. Scratches which are extremely prominent to the technical people of the industry nearly always go completely unnoticed by the average theatre patron, due, no doubt, to absorbing interest in the story. On the other hand, flicker on the screen must be avoided by all means.

Noticed or unnoticed, this mottle most surely has its effect upon the eye and upon the fatigue of the spectator. Although no scientific proofs of this are available, I believe that the comments of the spectators who are allowed to see both clean film and oily film, one after the other, are sufficient indication of the increased pleasure in viewing the mottle-free film.

This question of oil on the film has not had the attention given to it which it deserves. Heretofore, it has not been thought of as an actual damage to the film as is the more conspicuous scratch. Furthermore, one has thought that if oil does get on the film it can be removed by cleaning. It is true that oil may be removed easily from a small area of film with a clean pad and fresh carbon tetrachloride, but it is quite another matter to clean an entire roll effectively without streaks, bloom, abrasion marks, etc.

Thus it is that oil, which often gets on the film on its initial run, regardless of the quality of the house, usually stays there throughout the life of the film. Large sums of money are spent by film manufacturers, processing laboratories, and studios in order that the photographic quality of the pictures may be maintained at the highest possible level, yet this oil mottle often nullifies completely the careful work which has been done on the picture to this point.

The reason why oil spots on film produce mottle is well understood. Each oil spot produces a glossy surface which permits more of the light from this area to be focused on the screen than from the neighboring unoiled surfaces.

The remedy, of course, is to make the whole surface glossy so that there will be no more light coming from the oily spots than from the rest of the surfaces. This lacquer accomplishes this to a re-

(*Continued on page* 34)

†J. Soc. Mot. Pict. Eng. (February, 1941).

RCA's Theatre Tele Show on 15x20-Ft. Screen An Historic Event in the Electronics Art

By *JAMES J. FINN*

HISTORY was made in both the electronic and entertainment arts on January 24 when, for the first time anywhere, there was presented by RCA a program of radio-relayed, direct-pickup television images projected over a 60-ft. throw onto a 15 x 20 ft. screen located in the New Yorker Theatre on West 54th St., in New York City. The sound accompaniment for these television pictures, superb as it was when reproduced by RCA's new Multisonic reproducing system, must be relegated to a mere footnote spot for the present in the light of the magnificent technical achievement represented by the television program.

The program, no mere transmission over wires, but a real, honest-to-goodness ether hook-up over the distance of 68 miles between Camp Upton, Long Island, and New York City, at one fell swoop delivered a smashing blow to the detractors of television and proclaimed to the world that American television has "arrived." No extravagance of words could possibly over-emphasize the significance of this epochal demonstration to the motion picture industry.

Not content with this measure of success, RCA engineers further humiliated the critics of television by playing ring-around-the-rosy with the 68-mile circuit and successfully transmitting etherized television images from New York out to Long Island and then back to the New Yorker Theatre's large screen—a distance of 102 miles! This was the "clincher," the final crusher to the "No" boys.

Network Tele Possible

Meanwhile, and most significantly, the same images could be plucked out of the air by the General Electric television station outside Schenectady, N. Y.— 160 miles from New York City—for rebroadcast to all television set owners in that territory. Thus was laid to rest forever any question relative to the feasibility of chain television broadcasting on a nation-wide scale without the aid of interconnecting wire or special cable.

This exploit was RCA's contribution to a series of television demonstrations arranged by the National Television System Committee for members of the Federal Communications Commission and the press, which were also participated in by Du Mont (affiliated with Paramount Pictures); Columbia Broadcasting System, and Bell Telephone Laboratories.

The day-long program was opened by Du Mont with a demonstration designed to show the practicability of employing 625-line definition at 15 frames per second so as to obviate obsolescence of home receiving sets, especially in rural areas, in the event of changing television standards. It appears certain, however, that the F.C.C. will okay the 441-line, 30 frames per second image as a standard, this being the basis of operation for RCA and other leaders in the art.

Next came a showing by CBS of its television in natural color, presenting images of fine detail and great beauty which suggests splendid future possibilities, but which is wire-transmitted and only about 1 square foot in area.

The Bell Labs exhibition consisted of shorts and test patterns which were "piped" over coaxial cable from New York to Philadelphia and return, a distance of about 200 miles. The sponsors of this system are proceeding on the supposition that television broadcasting will follow the pattern of sound broadcasting to date in utilizing wire hookups for nation-wide coverage.

New RCA Tele Receiver

But the big noise of the day's proceedings was RCA—all the way. While the theatre show is of paramount interest to I. P. readers, the RCA demonstration in the National Broadcasting Co. studios certainly was not lacking in interest and import to the motion picture industry. Decidedly not!

Introducing a new design of home-television receiver, incorporating numerous developments that make possible a larger picture than heretofore seen on home-receivers, RCA has developed an instrument with a 13½ by 18-inch screen. This developmental receiver is model TRK-120 modified to permit the use of a 5-inch projection Kinescope in place of the regular 12-inch Kinescope heretofore used to present an 8 by 10-inch picture. The new receiver is equipped with a retractable translucent screen, which slides down into the cabinet when the set is not in use. When in use, the screen is at the top of the set.

The size of the picture on the face of the new 5-inch projection Kinescope is 2¾ by 3⅝ inches. The funnel-shaped tube, with its face pointed upward, is mounted on the floor of the cabinet. The picture as it appears on the flat face of the Kinescope is enlarged by means of a coated *f*/2 lens of American design and projected to a mirror on the underside of the uptilted lid of the cabinet, from where it is reflected to the 13½ by 18-inch translucent viewing screen.

Although the projected 441-line, 30-frame picture has 3½ times the area of a regular Kinescope receiver, the brightness of the image is the same. The projection Kinescope principle, such as used in this receiver, makes it possible to produce pictures of any desired size.

Then followed a demonstration of etherized facsimile transmission which, while of only passing interest to motion picture people at present, should give the newspapers of America plenty to worry about. The facsimile instrument prints on a strip of paper 8 inches wide at a speed of 1¼ inches a minute, making it possible to reproduce a message the size of a business letterhead, or an 8 by 10-inch picture, in less than ten minutes.

Studio Program Impressive

The succeeding program of late news broadcast by Lowell Thomas, a travel film with narration by Carveth Wells in person, a talk by Dr. James R. Angell, N.B.C. educational counsellor; songs by Betty Hutton, and a popular radio playlet, "The Aldrich Family,"— all these etherized from a studio in the RCA building to the Empire State Building a mile away, and then transmitted back to the RCA building, where they were

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CHANGE PATENT LAWS—ARNOLD

Patent laws should be changed so that owners of patents would be required to grant unrestricted licenses if they grant any licenses at all, and to prevent the imposition of restrictions upon the buyer in the sales of patented articles by the patent owner, Thurman W. Arnold, U. S. Assistant Attorney General, has recommended to the TNEC. The anti-trust division head also proposed much stiffer penalties for persons convicted of violating the Sherman law.

Arnold told the committee that the Supreme Court's recent decision in the Hutcheson case has removed his authority to institute legal action to combat jurisdictional strikes. "The labor practices we have characterized as economic evils are not common to the majority of labor unions," Arnold asserted.

picked up by the new television receivers. Also shown were scenes from Camp Upton, Long Island, as picked up by the N.B.C. mobile unit and relayed over the 68-mile radio circuit mentioned previously.

The Camp Upton scenes were particularly impressive, because on that day the New York area experienced some of the worst weather of the winter, with rain, snow and sleet pouring down from low-hanging leaden skies. Despite this handicap, the images came through with remarkable detail.

Effect on Film Industry

But the *piece de resistance* of the studio show was the playlet, "The Aldrich Family." This sketch, "shot" by the television camera in a 40-ft. square studio that would put to shame the Hollywood technicians, was imaged on six receivers spotted about a large room and succeeded in holding the close attention of approximately 200 engineers and newsmen. So absorbing was this presentation that the writer forgot completely that he was watching a television demonstration. When this effect can be obtained through a succession of swiftly changing scenes demanding the utilization of the highest degree of continuity, with all the tricks of the photographic art that this phrase implies, then it must be stated that these television fellows have something—and how!

The writer cannot conceive of any motion picture man witnessing this demonstration without being assailed by grave doubts as to the probable effect of television upon the cinematic art, which is to say upon the entertainment preferences of the masses. The dramatic sock exhibited by this playlet and its accompanying impact upon the mind of the writer is something that cannot be conveyed in words; it must be seen to be fully appreciated.

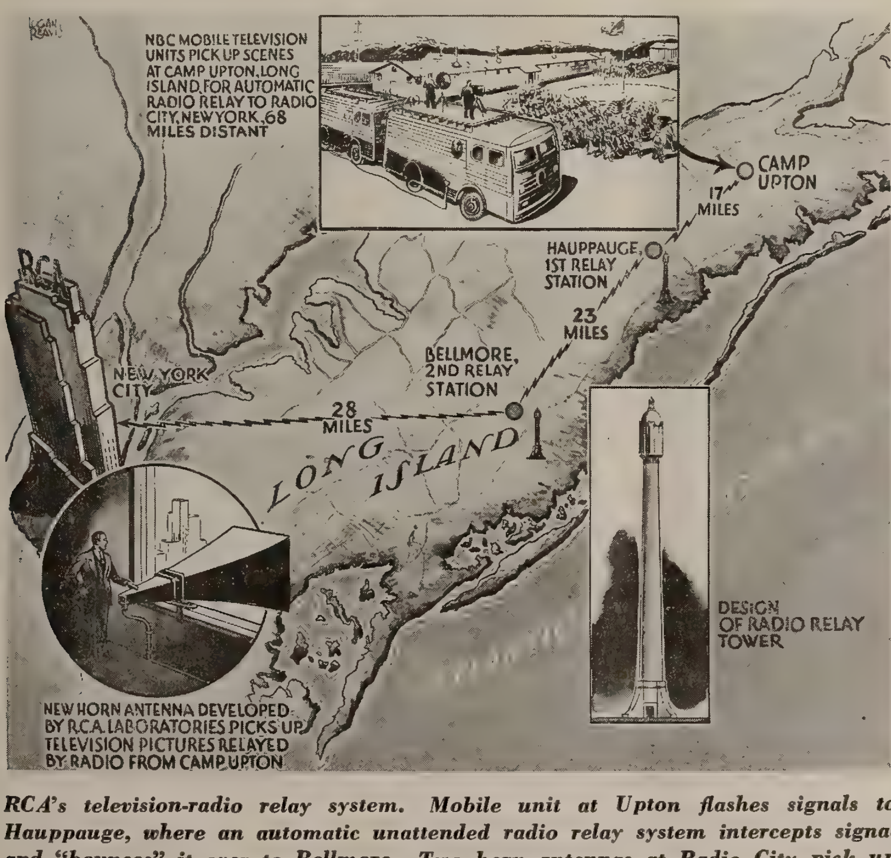
The hour-long show at the New Yorker Theatre utilized a miscellany of studio entertainment in addition to the outdoor scenes of Camp Upton mentioned previously. Considering the weather conditions and the fact that a 15 by 20-ft. image was being projected, one might expect sub-par picture quality. Here again, however, was evidenced the same good quality of light and detail that had marked the studio shows. On the basis of results obtained under prevailing weather conditions, it seems safe to say that on a clear day the showing would have been nothing short of sensational.

Combo Film-Flesh Playlet

The theatre program wound up with the presentation of another playlet, "K-7," a story of military espionage during World War I. As televised, this production utilized both film clips and studio shots of "live" talent. Here again was evident a smooth production technique which switched from film to the studio scenes and back again with a precision that blended both elements into a flowing continuity. The dramatic effect of diving bombers, rattling machine guns, fighter-plane combat high in the air, shattering bomb explosions and crumbling buildings, with appropriate sound accompaniment as played over the new Multisonic sound system, can only be described as simply terrific.

New Yorker Theatre Set-Up for Television

A steel-barreled projector pointed over the edge of the balcony casts the television images on the stage screen 60 feet distant. Alongside the projector are control desks at which operators manipulate the knobs that regulate the picture and sound. These operators exercise the same control over faces and scenes as radio control men do over broadcast music and speech.



RCA's television-radio relay system. Mobile unit at Upton flashes signals to Hauppauge, where an automatic unattended radio relay system intercepts signal and "bounces" it over to Bellmore. Two horn antennas at Radio City pick up relay signal. Total distance covered is 68 miles.

The pictures, as they come over the wire from an outside point, are received first at the control desk to be fed into the projector. In demonstration, the Camp Upton scenes relayed by radio to the RCA Building, were forwarded from Radio City to the theatre over special wire circuits.

Close Control Possible

The large-screen theatre television system operates on signals delivered to it either by coaxial cable or by special wire circuits. The installation in the theatre consists of three main units: control, power supply, and optical system.

An array of knobs and dials on the control panel gives the operator immediate handling of all controlling, metering, and deflecting elements. He can obtain at any time, every possible check on the operation of the system. Sharpness, brightness, contrast, and size of the image projected may be changed by the turn of a knob. The controls are so simplified that the average motion picture projectionist could operate the unit with a minimum of special training.

The second unit, the power supply for the optical or projection system, is a conventional high-voltage rectifier rated at 70,000 volts. Normally, operation is at 60,000 volts.

Receiving Optical Train

The optical, or projection, unit is considered the most important as well as the most complicated of the entire system. For purposes of description, it is possible to divide the unit into three principal elements; that is, the Kinescope, or projection tube; the reflecting mirror, and the correcting lens, or plate.

The Kinescope, built to handle high

voltages, is similar in performance to the Kinescope used in RCA's standard home-television receivers. The face or diameter of the tube is 7 inches; the tube's length is 14 inches. It is mounted in the center of a hollow steel-shielded cylinder 34 inches in diameter and 34 inches long. The face of the tube is pointed away from the stage screen, and the end of its neck pierces a small hole in the center of the correcting plate of the optical system.

Extremely Fast Optics

The concave reflecting mirror, 30 inches in diameter, is mounted a few inches in front of the tube's face. The image on the face of the tube is picked up on the concave surface of the mirror, passed through the correcting lens and onto the screen with a magnification of 45 times. The lens corrects for aberrations and passes the image across the auditorium to the stage screen.

The optical system is unique in that it has a speed rating of $f/0.7$, which surpasses the fastest known projection lens. Developed by RCA research engineers, it is a variation of the Schmidt astronomical camera. Optical experts viewed the idea in the beginning as impractical, but an RCA engineer whose hobby is optics, figured out a formula, devised special grinding instruments, and successfully developed the optical system. The first unit required six months to produce, but the technique of grinding the lens was improved to the point where one can now be ground in six weeks.

The optical unit housing is mounted on a pedestal which contains the video amplifiers and the deflecting output circuits. Because of the optical unit's high efficiency, the screen illumination obtainable in the RCA system is adequate for large-screen pictures in theatres.

Radio Relay System

The automatic radio relay of scenes from Camp Upton, to New York brought into use the new *unattended* radio stations which "bounce" television pictures across the countryside without the use of wire connections. This radio relay system, developed by RCA, incorporates a number of engineering features and innovations in communication. The relay towers, as designed for future use, are envisaged dotting the landscape to make possible inter-city television and eventually a television network on a national scale.

Inside the "beacon" on top of the tower is a new horn antenna sharply directional in reception and transmission of ultra-short waves. The towers vary in height, depending upon the terrain and distance to be covered. The automatic apparatus for amplifying and relaying is located in the base of the tower. In a split-second after the pick-up and amplification of the signal, the pictures are "searchlighted" in the desired direction.

The mobile units of N.B.C. stationed on this occasion at Camp Upton, televise and flash the pictures on the 165-megacycle channel to Hauppauge, 17 miles distant. Hauppauge's automatic relay station intercepts the images and tosses them across 23 miles on 474 megacycles to a horn antenna 200 feet up on a mast formerly used by WEAF at Bellmore. There again, amplification strengthens the picture-carrying impulses for relay on 506 megacycles to New York, 28 miles beeline.

In no instance does the power of the intermediate relay stations exceed 5 watts, an accomplishment attributed in part to the highly directional horn antennas.

New and Unique Tube

Another device of considerable importance to the system is a new RCA tube technically described by the engineers as of "the inductive output type." With this tube, amplification of the television signals at the relay stations is effected at radio frequencies instead of the original frequency of modulation. This tube makes possible the streamlining, simplification, efficiency and economy of operation of the radio relay stations.

Taking further advantage of new development in radio tubes, the relay system in the low power stages (receiving circuit) utilizes a new "orbital beam" tube. Operating in general on the electron multiplier principle, this tube is a new means of obtaining high amplification on ultra-high frequencies.

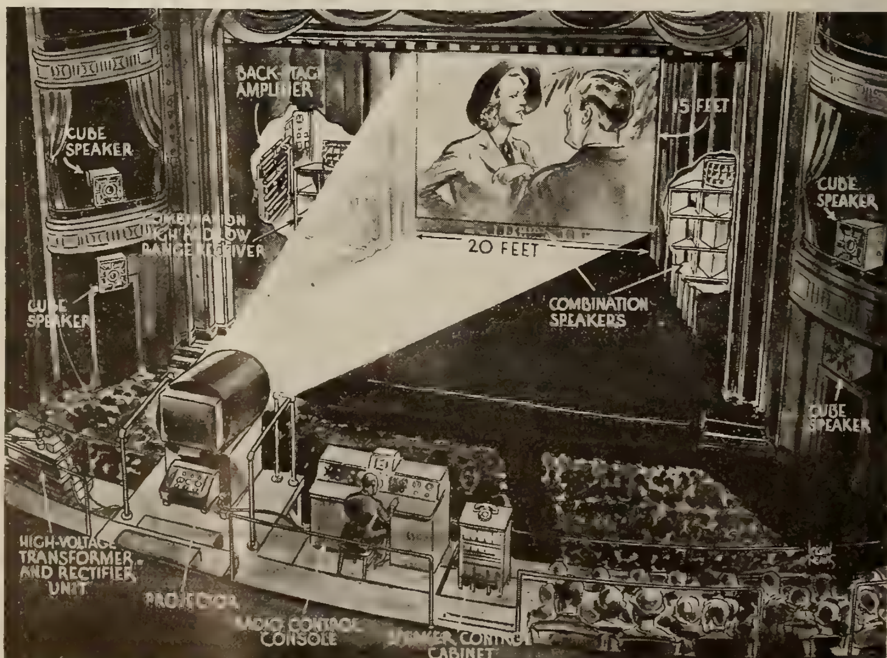
Protruding from a window on the 62nd floor of the RCA Building at Radio City, two horn antennas with their open mouths pointed in the direction of Bellmore, pick up the incoming ultra-short waves that carry the telepictures. These horns, from their 4 by 6-foot openings, taper along the 8-foot length to an apex about $1\frac{1}{2}$ feet square, where a dipole antenna is located. The impulses are fed into the television sets at Radio City, and are also sent over a special wire line to the New Yorker Theatre for projection on the 15 by 20-ft. screen. The pictures are 441 lines, 30 frames.

Sound Reproducing System

The sound reproduction system used in connection with the theatre television unit is of the extreme high fidelity type, similar in effect and arrangement to the "Fantasound" but differing in that it is manually controlled at the scene of reproduction.

Controls for the sound, which accompanies the television projection, are mounted in a separate console, adjacent to the television control desk. They are linked to 18 high- and low-frequency loudspeakers mounted around the auditorium. Wire lines connect the console with the NBC studios and with the central radio receiving point in Radio City. In addition, there are lines which the sound control engineers use for cueing the program.

Three banks of regular RCA speakers (*Continued at foot of next page*)



Theatre television set-up. Telepictures are projected to 15 x 20-ft. screen from steel-jacketed projector. Operators at desks regulate focus, brilliance and sound volume. 18 high- and low-frequency speakers throughout theatre are used in multisonic reproduction

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

HAVE you ever been bothered with intermittent noise and wondered just how a service engineer goes about tracing down this most elusive type of trouble? The following is copied verbatum from an Emergency Call Report in connection with an intermittent noise which had again developed in a sound system after being absent for three weeks. At the time of this call the noise had become so bad that sound was not intelligible. Tests, previously arranged, had been tried by the theatre personnel with no success.

"The entire ground system was followed through and all wiring checked and connections resoldered. A new ground wire was run to a separate location away from the room and used to ground the volume control cabinet alone. All shields were rebonded on speech lines. Every connection in the TA-753 control cabinet was checked and resoldered as well as those on the 211 reproducer set.

"All condensers in the 91 amplifier tightened, and the common ground for this amplifier was remade and tightened. The power lines were all checked at switches, and one very bad connection was found in main power switch to the room equipment. It was so badly burned that the bolt holding terminal lug broke off and the switch had to be taken apart and new bolt installed.

"Ground clamps were cleaned and pipes (cold water) cleaned. Conduit connections (locknuts) were tightened. All tubes, including those in monitor were checked and found O.K. The system was checked for normal operation by running film, and results were satisfactory. Finally, the system was permitted to cool off for a couple of hours before the evening show, and results were satisfactory.—S. H. MYERS, Altec, *Oakland, Calif.*"

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While working on the sound equipment aboard a boat recently, I noted a bulletin as follows:

NOTICE TO ALL OPERATORS

"It is dangerous to use pins in making a film splice—the next operator may stick himself. Alway use clips.—S. B. EPSTEIN, RCA, *San Francisco.*"

• • •

There has been at various intervals discussions by projectionists in I.P. in regard to the difficulties experienced in trying to get rid of flicker on the screen, in some cases all attempts to eliminate this trouble being unsuccessful.

Though many remedies were tried there was one cause of this difficulty that was not mentioned in any of the discussions, namely, poor rectification of the arc supply unit, poor filtering of the current supplied, and, sometimes, poor commutation of the arc generators.

I have located the source of such screen flicker several times and definitely found it to come from the arc supply. It is relatively easy to locate. In the case of an arc generator, switching from one generator supply to the other usually shows the source as, it is seldom that both generators are poor at the same time. In the case of bulb or copper-oxide rectifiers, interchanging the supply units gives unmistakable proof. For example, No. 1 power supply unit supplies No. 1 arc; connecting No. 1 to supply No. 2 arc and No. 2 to supply No. 1 arc. If the flicker persists, it is not the rectifier; if it goes to the other arc, it is definitely coming from the power supply.— W. H. HOWARD, RCA, *New York City.*

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The following is a good recipe for cleaning mirrors as practiced by one of my projectionist friends:

1. Wash mirror with lukewarm water and dry thoroughly.
2. Apply a light coat of Johnson's "Shi-Nup" Household Cleaner and Silver Polish and allow to dry thoroughly.
3. Wipe and polish with soft cloth, preferably of flannel or silk.

Note:—This procedure is especially good for cleaning mirrors in the Suprex type of lamps as it thoroughly removes the smoky residue deposited on mirror when striking the arc, and without scratching the mirror. I have seen mirrors which have been in operation for almost three years which are almost as good as new.—M. W. TILDEN, RCA, *Baltimore, Md.*

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A case of bad noise in the sound in a Boston theatre was traced to defective brushes in a ventilating fan installed in the men's room.—C. S. LUNDY, Altec, *Boston.*

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Last month I received an emergency call because the exciter lamp base in a Simplex sound head was broken in five different places. The upper stud for the exciter lamp holder had pulled right out of the Bakelite base. In order to keep the show going while a replacement was being shipped, I was able to get by through the expedient of gluing the base together and binding it with wire.—S. A. POND, Altec, *Duluth, Minn.*

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Here is another one on fuses, that most common of all electrical items and one which can shut down a show as positively as any other thing. Projectionists should know the location and purpose of every fuse in his sound system circuits all the way from the house meter to the lowly p.e.c. fuse.

To illustrate this homely observation is another case of no sound on either machine which the theatre personnel traced to the lack of filament and exciter lamp current output from the TA-7276 power unit. All fuses were reported

RCA THEATRE TELE SET-UP

(*Continued from preceding page*)

are set up on the stage near the screen. One bank is at the rear of the screen, and the other two are at either side. Beginning at the outer edge of the proscenium arch, other loudspeakers are located at desired points along the side wall and in the rear of the auditorium. One large loudspeaker is suspended from the ceiling.

The sound control engineer in the theatre, taking his cue from engineers at the pick-up scene, is able to cause the sound to move from left to right or right to left, or to remain stationary in synchronization with the action on the screen. Whenever desirable, he can cause the sound to come from the left or right of the house, from the rear, and from above. Also, in effect, he can make the sound run around the house.

to be good. To get the show going immediately, storage batteries were resorted to.

The trouble was finally traced to a burned out fuse in the *plate* circuit of one of the tungar bulbs in the power unit. Since the tungar bulb associated with the burned out fuse had lighted all right, it had been concluded that the fuse was good. The theatre personnel had thought, erroneously, that the fuse was in the filament circuit of the tungar bulb; instead, the fuse was in the plate circuit, and when it burned out the plate current was opened and the bulb stopped rectifying, although its filament continued to light.

"Know your fuses" should be made a projection room proverb.—F. B. MEWBORN, Altec, *Norfolk, Va.*

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We often receive emergency calls anent film weave causing hum or "motorboating," where the trouble is caused by film the width of which has been reduced by either the projectionist or the rewinders and examiners at the exchanges.

When rewinding by hand, the film may be on the spool unevenly, and the weight of the other reel has a tendency to break the edges. These edges are cut off with scissors, thus reducing the width of the film and causing it to weave. I have seen reels of film with two or three hundred feet cut like this. Naturally, the framing lines occasion extraneous sound each time the reel is run through.—H. J. MAYER, RCA, *New York City.*

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Not infrequently projectionists experience difficulty replacing pre-focused exciter lamps. This is an arrangement by which the base of the lamp is held in position by three studs under tension. Removal or installation of the lamp without relieving the pressure results in damage to the lamp. This pressure may be relieved by pushing up the base of the lamp holder; observe the three studs rising when this pressure is applied. Installation or removal of exciter lamp then becomes easy.—J. DEL BELLO, RCA, *Philadelphia.*

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Many rooms are so built as to make it difficult for the projectionist to watch the screen while in the rewind room or other out-of-the-way places. If a mirror about one-eighth inch square is placed on a thin wire and supported in front of the shutter, a picture can be thrown on the rear wall, side wall, or ceiling of the projection room without affecting in any way the screen image in the theatre. —S. S. LEBOW, RCA, *New York City.*

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Often a projectionist will report a lower take-up operating improperly. He will tighten the spring tension, but it still will not operate properly. Examine the belt and it will usually be stretched and slipping in the pulley. A good quick check is to watch the lower belt pulley: if it runs fast and then slows down, the belt is too loose. Keep a good belt in operation and keep it tight. Keep the leather clean and soft (a little "Neat Foot" oil helps), and the spring tension at a minimum consistent with proper take-up action.—J. R. MACLEMORE, RCA, *Roanoke, Va.*

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In some cases where a pilot lamp is connected across an inductive load, the lamp will burn out when the control switch is opened. The inductive surge through the lamp can be eliminated by connecting the lamp between the load leg on one side of the switch and the line leg on the other side of the switch.—NEIL BARBERIE, RCA, *Boston.*

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A theatre reported that it was operating on one machine due to it having burned out an exciter lamp and not having a spare lamp. The exciter lamp was of the rare 4-volt, .75 ampere variety, and none could be procured from nearby points for love or money.

In order to keep the show from closing, I procured a standard 8-volt, 2-ampere lamp from a nearby theatre and picked up a storage battery to operate it. The 8-volt, 2-ampere lamp, of course, would not fit in the socket which was designed to hold the 4-volt, .75 ampere lamp normally used. Therefore, it was necessary to remove the lamp bracket and fasten the replacement lamp by some other means in the reproducer and in the proper location so that the filament of the lamp lined up with the lens tube. Tape was used to fasten the lamp and, although it was somewhat makeshift, it served the purpose until a new stock of exciters arrived.—E. S. HAWES, Altec, *Memphis, Tenn.*

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Do you know that in case of fader trouble in a W. E. system having a 702-type control cabinet and 41-type amplifier, the defective fader can be cut out by using the "Repro. No." key on the fader and the sound volume can be regulated by the gain control on the 41 amplifier set.—C. W. HILLIARD, Altec, *Newark, N. J.*

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One of my theatres was having a spell of motor speed trouble. On the last reel during the last show of the evening the motor would not come up to speed, and when the show was opened the next day the motor ran too fast.

Believe it or not, the projectionist, in order to keep the show going without a break while I was enroute to the theatre, very successfully kept the speed regulated satisfactorily by turning on and off the power of the motor. When the motor began running too fast, he would turn off the power for a split second until it slowed down and then turn on the power again.

I found the cause of the trouble to be a defective transformer in the motor control cabinet.—STEVE WELSH, Altec, *Chicago.*

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A recent emergency call reporting no sound on No. 1 machine. The trouble was found to be caused by a heavy film of moisture on the lenses of the optical system and on the p. e. Cell.

Here is the apparent explanation for this unusual condition: during the night the ventilator located above No. 1 machine had been blown open by the wind and the cold air which came in thoroughly chilled the machine; then, when the room warmed up the following morning a heavy condensation of atmospheric moisture collected on the cold machine. Although the moisture was wiped off the outer surfaces of the machine, it persisted on the lenses of the optical system and the p. e. Cell.

The condition seemed to be the same as that experienced by a person wearing glasses when he comes into a warm humid room after being outside in the cold for a sufficiently long time to thoroughly chill the lenses of his glasses.—H. M. SMITH, Altec, *Chicago.*

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Those little brass brushes the "5 & 10" sell called "Suede Brush" are just right for cleaning any metal surface which is dirty or coated with rust. Sometimes film sprockets become rusty on the inside where they are not wiped every day. Exciter lamp contacts just shine when given a few strokes with this brush.—J. R. MCLEMORE, RCA, *Baltimore, Md.*

New home of G-M Laboratories, of Chicago, pioneer manufacturers of electronic products, whose p.e. cells are used extensively in the sound motion picture field

Fundamentals of Sound Reproduction

A Review, by RCA Photophone Engineers, of the Basic Elements of the Art

THE AIR has a certain weight which bears down upon us and thus subjects us constantly to some pressure. At sea level this pressure is approximately 15 pounds per square inch. At higher altitudes, such as on mountain peaks or up in airplanes, the pressure is less. Instruments for measuring altitude, such as are used in aeronautics, operate by measuring air pressure. As the altitude is increased, the air pressure decreases, and these instruments instead of reading pressure directly are calibrated to read altitude expressed in terms of feet.

The air is in a state of constant turbulence and, therefore, the air pressure is not always the same but varies from day to day, depending upon weather conditions. Consequently, the barometer, which is an instrument for measuring air pressure, has been regarded as a device for predicting weather conditions.

Figure 1 illustrates a time-pressure chart for some specific location, in which the average pressure is 15 pounds per square inch. However, superimposed upon this average is a large number of small variations, the amplitude of which has been exaggerated for the purpose of explanation.

These variations represent sound waves which are merely successive pressure waves caused by the movement of objects within the air. For example, a hand clap violently forces the air from between the hands, and the air thus displaced causes a compression wave to travel outward from the point of disturbance.

This pressure wave travels at constant velocity, but its amplitude diminishes as it progresses. It can be heard as sound at any point along its path where the amplitude is sufficiently great to be detected by the ear of a listener.

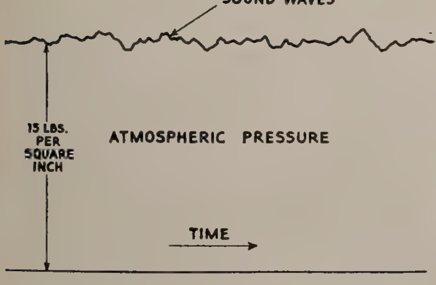

FIGURE 1. ***Nature of sound***

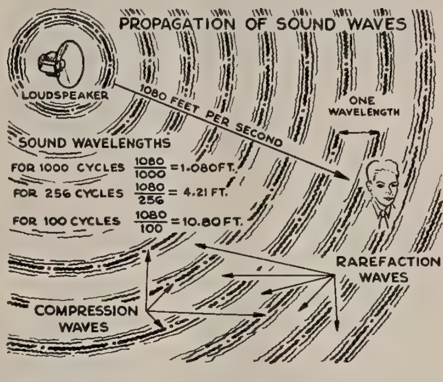

FIGURE 2. ***Propagation of sound waves***

In the upper left corner of Fig. 2 is a loudspeaker which is being driven by electrical energy of constant frequency. The vibrating cone pushes the air back and forth. When the cone moves outward it compresses the air in front of it, and when the cone moves backward it causes a rarefaction or a partial vacuum in the air.

Sound Wave Propagation

These alternate pressures and rarefactions travel outwardly with a wave motion as shown in this illustration, the dotted lines indicating the pressure waves and the spaces between the dotted lines indicating the vacuum or rarefaction waves. The listener, indicated on the right of the illustration, hears these waves as soon as they arrive at his ear. The waves travel outwardly from the source at a velocity which, for air is approximately 1,080 feet per second at 0 degrees C. The velocity varies somewhat with atmospheric conditions such as temperature and barometric pressure.

As the rate of travel is constant, it will be seen that the distance from one wave crest to the next will be less for a high-frequency tone than it will be for a low-frequency tone. For a high-frequency tone, the cone of the loudspeaker would vibrate rapidly and one wave would not travel far from the loudspeaker before the next wave started; while for low-frequency tones, one wave would travel a much greater distance from the loudspeaker before the next wave started.

The distance from the crest of one wave to that of the next is known as one wavelength. This is shown in the upper right corner of the diagram. Knowing the rate of travel and frequency, we can readily compute the wavelength by dividing the velocity by the frequency. For 1,000 cycles per second, this would be 1,080 divided by 1,000 or slightly over 1 foot.

The wavelength for middle "C" on the piano, which is 256 cycles per second, is 4.2 feet. For 100 cycles per second, the wavelength is 10.8 feet. It will be noted that the wavelengths of sound are considerably shorter than radio signal wavelengths, due to their lower velocity. Sound waves travel approximately 1,080 feet per second, while radio waves travel approximately 186,330 miles in the same period of time

The Human Ear Structure

It may be instructive, as well as interesting, to consider briefly the mechanics of the human ear. Fig. 3 shows a cross-section of the ear. The left portion of the illustration shows the outer part of the ear, which is known as the pinna. From the center of the pinna a tube leads into the middle part, known as the middle ear. The pinna collects sound waves and directs them into this tube.

The human pinna, however, is not a very efficient sound collector, as can be demonstrated if the hand is cupped behind the ear, which assists considerably to intensify the sounds one hears. Across the inner end of the tube is a membrane known as the "ear drum." Variations of air pressure cause the ear drum to vibrate, and these vibrations are passed on by suitable mechanisms to the proper nerve centers.

In order that changes of barometric

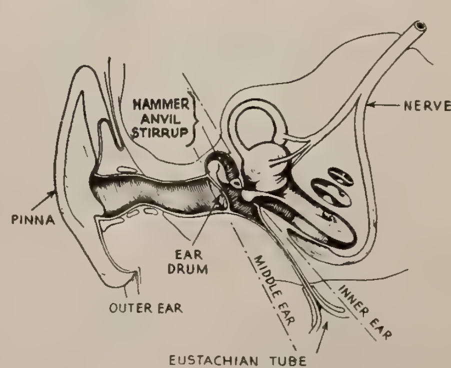

FIGURE 3. ***The human ear***

pressure will not affect the ear drum by causing a greater or lesser pressure on the outer side of the ear drum, there is a tube leading from the inner ear directly into the mouth to permit equalization of the average pressure on both sides of the ear drum. This tube is called the "eustachian tube."

Sound vibrations do not readily travel up the eustachian tube, because it is very small and does not have direct access to the outer air. Sometimes during illness this tube becomes closed, causing an impairment of hearing.

Every one, no doubt, has noticed that when the elevation is changed suddenly, such as when going up or down in an elevator, there is a peculiar sensation in the ear. This usually can be relieved by opening the mouth widely or by swallowing. Likewise, soldiers connected with artillery units are instructed to keep their mouths wide open when their gun is being fired so that the eustachian tube may be fully effective in promptly equalizing the pressure and thus help to prevent shattered ear drums.

Attached to the ear drum is a series of small bones known as "hammer," "anvil," and "stirrup." These small bones are vibrated by the ear drum and pass the vibrations along to another membrane, which closes a cavity filled with liquid, and it is within this cavity that the nerve endings pick up the sensation of sound.

These nerve endings are small, hairlike devices which protrude into the liquid from the sides of the spiral canal shown in the illustration. Above this and to the left will be seen what is known as the semi-circular canal in the ear. This canal has no connection with the function of hearing, but does influence the sensation of stability and equilibrium of the body.

It will be noticed that the ear is considered as being made up of three major sections, which are known as the outer ear, middle ear, and the inner ear. The outer ear is the section from the ear drum out and contains air which is subject to sound vibrations.

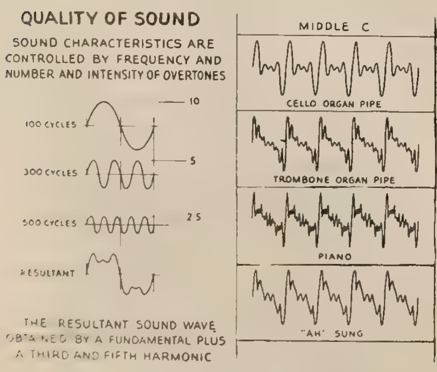

FIGURE 4. *Quality of sound*

THE FREQUENCY DOUBLES EACH OCTAVE
THE FREQUENCY INCREASES BY THE TWELFTH ROOT OF TWO (1.059) FOR EACH HALF TONE.
MUSICAL CHORDS ARE COMBINATIONS OF NOTES WHICH ARE PLEASING TO THE EAR, SUCH AS C, E AND G

FIGURE 5. *Musical scale*

The middle ear is not subject to sound vibrations, because the pressure of the air it contains ordinarily changes only very slowly, as explained previously. Sound vibrations are carried across the middle ear by means of mechanical vibrations in the small bones, the "hammer," "anvil," and "stirrup."

The inner ear is shown to the right of the middle ear. It is closed off by membranes and is filled with a liquid which transmits the sound vibrations from the membranes to the nerve endings.

The large bundle of nerves which carry the sound sensations to the brain can be seen leading off to the upper right of the illustration. This nerve when dissected and seen under a microscope has a very striking resemblance to a telephone cable which has a large number of wires bundled together. Just how the sound impulses or sensations are carried to the brain and registered as sound are not entirely understood.

The Quality of Sound

If a chart is made of the variations of air pressure caused by a single frequency note, such as produced by a tuning fork, it will consist of a smooth curve known as a sine wave. Such a curve is shown at the top left in Fig. 4. However, musical notes are rarely such pure tones, but instead contain a basic frequency and various harmonics of this frequency.

On the bottom left of the chart is shown a curve corresponding to a sound wave which more nearly conforms to the more complex type produced by a musical instrument. This wave is caused by combining the fundamental wave at the top plus its third and fifth harmonics.

The wave at the top is one cycle of a 100-cycle-per-second wave having an amplitude of 10 units. Adding to this, its third harmonic, which would be 300 cycles, having an amplitude of 5 units, and the fifth harmonic, which would be 500 cycles, having an amplitude of 2½ units, produces the resultant wave shown at the bottom. Conversely, any irregular periodically recurrent wave can be resolved into its fundamental frequency and harmonics.

It is these harmonics, or overtones as they are called in music, that give the characteristic quality to a particular note. For instance, if middle "C" is played on the piano, it sounds different from middle "C" on a violin, although the fundamental tone of both is middle "C." The difference is caused entirely by the relative strengths and numbers of harmonics.

The same may be said of sounds which are not musical tones. For example, one person's voice is different from another's due to the overtones. The sound of one's voice is produced by the vibration of the vocal cords and resonances in the mouth and throat cavities. No two people are exactly alike physically, and consequently their voices do not sound the same.

On the right side of the illustration are four graphs of sound waves, all of which depict the note, middle "C." The top graph corresponds to a sound wave of a 'cello organ pipe when playing middle "C"; the third is for middle "C" of a piano; and the one on the bottom corresponds to the syllable "ah" when being sung by a soloist at middle "C."

All of these have the fundamental frequency of middle "C," 256 cycles per second, but it will be noticed that no two characteristics are alike. Mechanical and acoustical differences of the various instruments cause different mixtures of the fundamental and harmonics, and as a result each endows the same note with a highly individual characteristic.

The Musical Scale

Fig. 5 shows one octave of a piano keyboard starting with middle "C." The physical pitch for middle "C" is 256 cycles per second, and for each octave the frequency doubles, consequently the frequency of "C," one octave above middle "C" would be 512 cycles per second.

Inasmuch as the scale is divided into twelve half-tones, each half-tone will have a difference in frequency from the one adjacent to it by the 12th root of 2. The 12th root of 2 is 1.059, so if any frequency is multiplied by 1.059, the frequency of the half-tone above it will be obtained—that is, one half-tone above middle "C" will be "C" sharp and would be played on the black key between "C" and "D." It will be noticed that there

$$\left.\begin{matrix} C:E:G \\ F:A:C \end{matrix}\right\} 4:5:6$$

	C	E	G		F	A	C
64	256	320	384	85.3	341.3	426.6	512
	4	5	6		4	5	6

NOTE	FUNDAMENTAL	HARMONICS							
		2ND	3RD	4TH	5TH	6TH	7TH	8TH	9TH
C	256	512	768	1024	1280	1536	1292	1648	2304
E	320	640	960	1280	1600	1920	2240	2560	2880
G	384	768	1152	1536	1920	2304	2708	3072	3456

FIGURE. 6. *Musical chords*

are half-tones between "C" and "D," "D" and "E," "F" and "G," "G" and "A," and "A" and "B," and there is only a half-tone difference between "E" and "F," and "B" and "C."

As has already been seen, each one of these keys when depressed, not only produces the fundamental frequency but also an array of overtones of harmonic frequencies. It is primarily because of these overtones that musical chords are produced.

A musical chord is defined as a combination of notes which are pleasing to the ear. For instance, the notes F, A and C produce a pleasing musical chord. The notes D, E and F produce only a jarring discord, not pleasing to the ear. To be pleasing, the fundamental frequencies of the tones must conform to each other in a definite ratio—that is, the frequencies of C, E and G are in the ratio of 4:5:6. The frequencies of F, A and C are also in this same ratio. There are other ratios which will give other types of chords, such as minor chords, etc.

In Fig. 6 are shown the chords, C, E, G, and F, A, C having a ratio of 4:5:6. Any of these notes might be replaced by the corresponding note an octave below or above, or two octaves above or below, and so on without disturbing the harmony of the chords.

Musical Chords

The frequencies of these notes are shown at the top: middle "C" being 256, "C" 320, and "G" 384. Dividing these three frequencies by 64, the result is a ratio of 4:5:6. For the chord F, A, C, "F" is 341.3 cycles, "A" 426.6 cycles and "C" 512 cycles. Dividing this by 85.3, the result is again the ratio of 4:5:6.

In the chart at the bottom of the illustration are listed the fundamental frequencies for C, E and G plus their harmonics up to and including the ninth harmonic. On this chart is pointed out some of the obvious reasons why these notes make a pleasing combination. Notice that the third harmonic of "C" is the same as the second harmonic of "G," the fifth harmonic of "C" is the same as the fourth harmonic of "G," the sixth harmonic of "E" the same as the fifth harmonic of "G," and the ninth harmonic of "C" is the same as the sixth harmonic of "G." These are only some of the obvious reasons why this is a pleasing chord.

The beat between these various harmonics can be found by subtracting the harmonic frequencies. If a number of these subtractions are made it would be found that many of the beat notes between the harmonics correspond to other harmonics or the fundamentals themselves. An entire book could be written on the technical analysis of musical chords.

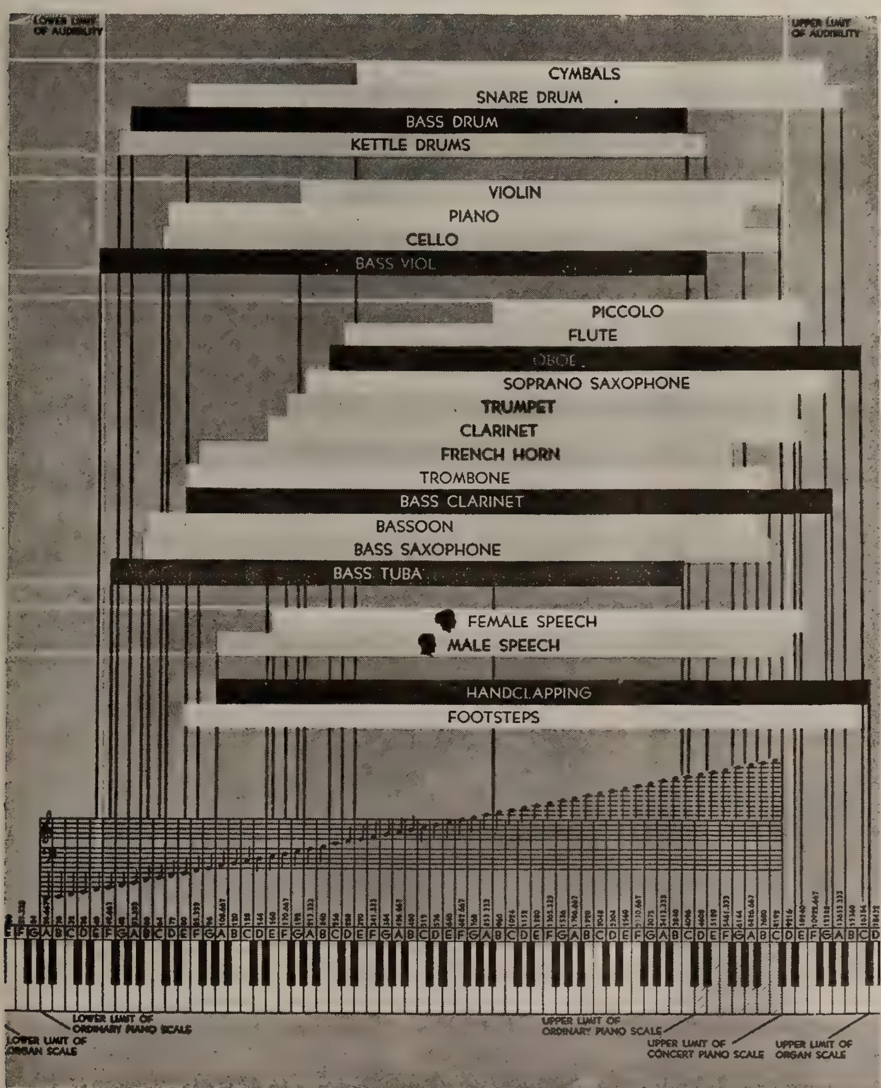

FIGURE 7. *Frequency range of musical instruments*

Instrument Overtone Range

Figure 7 is an illustration showing the range of various instruments, and several interesting things can be seen. For instance, one would hardly expect that sounds from a snare drum may be higher in frequency than any from a violin, but such is actually the case.

A snare drum is a precussion type of instrument—that is, it is struck in order to produce a sound. Across the drum head are stretched several strings which rattle on its surface, and it is this rattling which produces the harmonics carrying the frequency range of the snare drum very high. Also, the sound of the bass drum goes much higher than would be expected, for although its fundamental frequency is that of a dull thud, it generates harmonics which go almost as high as the ordinary piano scale.

It will be seen that the range of the female voice is from approximately 170 cycles to 10,000 cycles, and the range of the male voice is from approximately 100 cycles to 8,000 cycles. The sound produced by hand-clapping, while not musical, must be considered in the art of reproduction, and goes from approximately 100 cycles to 16,000 cycles, which is above audibility for many persons. The sound of footsteps is from approximately 80 cycles to about 15,000 cycles.

From this chart it can be seen that in order to reproduce sounds faithfully, the reproducing equipment must have a very wide range of response, at least up to 10,000 cycles.

While at the present time there are certain practical considerations that limit reproduction of both the upper and lower range of frequencies, modern sound systems are designed with a response capable of reproducing without distortion frequencies from 30 cycles to 10,000 cycles and above.

Suprex lamps have delivered the goods in small- and medium-size theatres; but the combination of a 125-ampere high-intensity lamp, coated lenses and the latest B. & L. condenser combination gives a picture that is a credit to the practice of projection. For large houses, naturally.

RCA's 'Panoramic' Sound System Ready Soon

Much of the thrilling realism of RCA Fantasound, developed especially for Walt Disney's "Fantasia" after years of effort may soon be available to neighborhood movie houses as well as metropolitan film palaces through the medium of RCA Panoramic Sound, according to Edward C. Cahill, Photophone Division Manager. Actually a simplified version of RCA Fantasound, RCA Panoramic Sound utilizes auxiliary amplifiers, and loudspeakers to the right and left of the screen, or at other locations in the theatre, and simplified control units installed in standard film soundheads. The auxiliary equipment is controlled by a special "cue" sound track on one side of the film.

Supplements Existing Systems

Speech is reproduced in the conventional way from a standard sound track over the regular system. For music, sound effects and other selected sequences the auxiliary loudspeakers are called upon to reproduce the same program material supplied to the regular channel. RCA Panoramic Sound principles have been applied experimentally by Warner Bros. in "The Santa Fe Trail," now being released. Establishment of film standards by the Academy must precede its general release to the industry.

"Panoramic Sound supplements modern standard sound systems at a small fraction of the cost of the elaborate Fantasound system," Mr. Cahill said. "It does not render obsolete nor unnecessary any component parts of the standard sound system. In fact, in the case of RCA Photophone soundheads, the single attachment required fits into mounting screw holes already provided. Panoramic Sound vitalizes screen entertainment by a practical and not too expensive method."

Heart of the system is the control track. (Because of its location, this track does not interfere with running the Panoramic film on standard soundhead systems, with the same reproduction as is provided by ordinary sound film.) The degree to which this track is blacked determines when the auxiliary channel feeding the additional amplifiers and loudspeakers comes into play, and how loudly it is made to reproduce. It also controls the amplification of the regular system, thus increasing the dynamic range of the sound reproduction from that part of the system as well.

The only alteration to the regular system, other than the simple soundhead attachment, is the insertion of an auxiliary variable gain amplifier in the link circuit between voltage and power amplifier.

Upstate Station Picks Up N. Y. City Tele Signals

The Helderberg television station, W2XB, was operated during much of the year on regular schedules for rebroadcasting New York programs and for telecasting productions originating in its own studio in Schenectady. The adjustments of the 1-kw. transmitter were refined and the superiority of the low-level modulation system demonstrated. The flexibility of this system is particularly gratifying to engineers because it is easily adapted, comparatively, to any contemplated new signal standards.

A ceiling mounted lighting unit using a three phase combination of the new water-cooled high-intensity mercury arc lamps was developed for television studio lighting. Orientation within a wide solid angle is easily accomplished through remote electrical controls.

Although regular engineering development continued, no new television receivers were produced during the year because of lack of markets, a condition brought about by an extension of the experimental period authorized by the F.C.C.

'AT YOUR SERVICE' ITEMS

Many recently designed theatre sound equipments produce a click or loud "bang" from the speakers when the electric picture changeovers are operated. This noise pick-up can almost certainly be eliminated by properly grounding the projectors, and connecting the changeovers to a leg of the theatre power service not supplying the sound amplifier system, and then, if necessary, by connecting two 1.-mfd. condensers across the three wires that usually terminate at one of the changeovers. Connections should be made at the changeover terminal screws.—M. E. Wheaton, RCA, *Boston.*

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An ideal film emulsion scraper that is easy to hold, sharp, cheap to make, and has a hole by which to hang it up, is made as follows:

Cut about three inches off the handle end of a used plastic-handle tooth brush. With a hack saw, cut a slot ½" deep, parallel to the longest cross section of the handle, on the end where the first cut was made. Place a Shick injector-type safety razor blade in the slot parallel to the handle. Heat the handle and squeeze the slot parallel to the handle. This will hold the blade securely.—E. D. Clifton, RCA, *Baltimore, Md.*

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I recently had occasion to improvise a microphone riser drive motor for remote operation, where the only motor available was a one-quarter horse, split phase, with centrifugal type starting switch. The starting and main winding leads were brought out to a double-pole, double-throw switch to provide for reversal. The operation was quite satisfactory, except that the repeated "inching" of the motor in this particular service proved rather disastrous to the centrifugal switch contacts.

This difficulty was overcome by connecting a 75-watt, 110-volt lamp across the starting switch contacts. The cold resistance of the Mazda lamp is low enough to assure ample starting torque, while the hot resistance is high enough to prevent damage to the starting winding.

While I have not had occasion to use this little stunt in an emergency, it appears that it would be a very satisfactory emergency expedient for operation of projector drive motors or motor generators suffering from starting switch ailments.—E. G. Hemenway, Altec, *Binghamton, N. Y.*

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Inspector Russ Holcomb is the father of the World's smallest engineer. His son weighed 2 lbs., 7 ozs. at birth (about 4 months ago), and after a protracted stay in an incubator he is now on the way to being the huskiest engineer in the Altec ranks.—Altec Los Angeles District Office.

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After several repetitions of fading and buzz troubles from MI-1511 power units, I have come to the conclusion that this sort of trouble is no longer a coincident.

Anyhow, the MI-1511 unit has six sockets for 5Z3 tubes. You can use from one to six for 115 volts, 200 mils. for each tube for horn fields. Coming out of the power transformer are two lugs ±5 volts. From each socket filament prong comes a wire, and six of each are put into a lug with solder and the lugs are bolted to the transformer lugs. Apparently acid core solder was used and the six-wire joint was corroded badly. This causes a lot of trouble, mainly fluctuating level of reproduction.—W. S. Welshonce, Altec, *Long Island, N. Y.*

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There are numerous "spot" type bed lamps now on the market that can be used for work lights in the projection room. The clamps on the base permit fastening them to the piece of equipment being worked on in such a way as to focus the light where needed and not in the worker's eye. Too, both hands are free, instead of having to hold a flash light or extension lamp in one hand and work with the other. Usually the extension cord should be replaced with a longer one.—W. W. Gilreath, RCA, *Dallas, Texas.*

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Filament socket spring contacts 43-A on amplifiers, when becoming pitted, can be turned over and the reverse side used to save the purchase of new contacts. They require only a reverse bending.—B. Epstein, RCA, *San Francisco.*

Mich. Bill Asks Electrician's License for Projectionists

Bill now pending in Michigan Legislature, requiring licensing for contracting and journeyman electricians, has a joker in provision that "any work involved in servicing, repairing, etc., of theatrical equipment, such as motion picture projection equipment. stereopticons, floodlight, spotlight, and other stage equipment" must be done or supervised by an operating engineer licensed by a contracting or journeyman electrician, or by an operating engineer licensed by the law.

Projectionists would have to secure electrician's license under the terms of the law. In addition, they could not, even then, do emergency repairs on a burned-out transformer or in similar emergencies to keep the show running, but would have to close down and wait for the regular repair man.

Projectionist locals and exhibitors are both proposing an amendment completely exempting theatres from the terms of the proposed bill. Source of the bill obviously is I.B.E.W.

FIRST MANAGER UNION DEAL

Jack Broder, Detroit theatre circuit owner, has signed what is believed to be the first contract with the new Theatre Managers Union, Local 22,312 A. F. of L. Contract, covering three theatres, provides for pay increase of $7.50 to $12.50 per week, for definite scheduling of hours, and some reduction of hours, for employment of "swing" manager who will relieve others to give them one night off each two weeks, and for employment of only union managers.

Demonstrating again that slashing equipment prices is no incentive to purchases of equipment by exhibitors: 1940 screen prices are approximately one-half those of 1931 for the various classifications, yet the total number of screens sold annually has decreased slightly rather than increased.

Film's Current Outlook Good, Says Poor's Reports

IMPROVED operations are forecast for the U. S. motion picture industry for the early months of 1941, at least, since theatre attendance in this country is expected to rise sufficiently to offset reduced revenues from European markets, according to Poor's Reports. Most concerns in the field are keeping production costs at a minimum and are concentrating their efforts on the development of the home market. Meanwhile, demand from American films from South American countries is improving.

In short, indications are that, inasmuch as English theatres have been blackened for some time because of the European War, the worst developments probably have been left behind. Since most equities representing the industry have given ample recognition to the unfavorable foreign influences in their price declines of recent months, general retention of motion picture equities is warranted.

Greater theatre attendance and box office receipts should develop during the next few months, at least, reflecting higher consumer incomes occasioned by war-stimulated business activity in this country. For the first nine months of 1940 the total of income payments to individuals was 6% higher than that for the corresponding 1939 period. Presumably, theatre attendance has risen at about the same rate.

Foresees Good 1941 Attendance

For 1941, one may be reasonably assured that domestic theatre attendance and receipts will far surpass those of 1940. Moreover, the improvement in prospect for 1941 is expected to be sufficient to offset any losses suffered from the foreign markets. For, even should so much as a 50% decline in foreign film rentals be suffered, a rise of less than 7% in total U. S. box office receipts in rentals would prove compensatory.

The Federal Government's antitrust suit against the industry was settled in November, 1940, through a consent decree, including, among other things, a provision requiring producers to sell films in blocks of five. The decree was signed by Paramount, R.K.O., Loew's, 20th-Fox, and Warners.

United Artists, Universal, and Columbia did not sign the decree, however, and are attacking its legality. As the situation now stands, these three companies feel that, having no theatres and holding a minor position in the industry, they are not subject to court proceedings on an antitrust charge. The larger companies, they feel, have benefited from the decree, inasmuch as the Government agreed to drop its theatre-divorcement proceedings.

A trend worth noticing is the inclination of the motion picture public to favor single-, rather than double-feature programs. Should the industry decide that the time is ripe to discontinue the practice of servicing the

double-feature market and to concentrate on the production of fewer, but better quality, single features, closer control over operating costs might easily result. The manifest benefit to net earnings, should box office tariffs be held at present levels, should go far in improving the industry's internal status.

Conn. 2-Men Shift Bill Argued

Argument for and against the so-called two-men projection shift bill was heard recently by the combined Senate and House Judiciary committees of the Connecticut Legislature. Provisions of the bill are as follows:

"While operating a moving picture machine, every operator shall devote his entire time and attention to that work. He shall not leave the operating side of a motor-driven machine at any time nor engage in unnecessary conversation with anyone, nor in any other work in the motion picture booth while operating a moving picture machine."

Exceptions to Bill's Provisions

The provisions of this bill are not to apply to projectors "using cellulose acetate films only of not more than 100 feet in length nor one inch in width and not requiring more than 500 watts, except when such films are used in regular places of exhibition charging admission, not including churches, lodge rooms, clubs." Cellulose acetate films of 1,000 feet, one and one-quarter inches wide using only inclosed incandescent lamp are also excepted.

Exhibitor objections to the bill took the usual pattern, that is, that the proposed legislation was a straightaway Labor proposition, rather than a safety measure, and that its enactment would force the closing of many small theatres in the State. Proponents of the bill stressed the need for safety in the theatre.

Appearing in behalf of the measure was John Egan, president of the Conn. State Federation of Labor; George Brazil, of I. A. Local 479, who as president of the State Association of Projectionists was in charge of the bill, and James J. Finn, editor of I. P.

No Delay on Super Cinephor Coated Lenses, Says B. & L.

[*Appended communication anent the availability of B. & L. coated Super Cinephor lenses is self-explanatory.*—Ed.]

My attention has been directed to statements appearing recently in International Projectionist wherein regret was expressed that defense orders would preclude the possibility of delivering any great quantity of *f*/2 coated lenses in the near future. I don't know on what information you based this statement, but I thought that you might be interested in knowing that for the first ten months of 1940 we delivered almost twice as many coated Super Cinephor lenses as we did for the twelve months of 1939.

It is a fact that there was delay in filling the orders promptly toward the latter part of 1939, which was largely due to the fact that we were forced to make the announcement and put the lens on the market before it was ready because of the demand from Loew's for their "Gone With the Wind" installa-

tions. In our desire to render maximum assistance to the Loew people we really went ahead before these coated lenses were in the regular production stage.

At present we are rapidly catching up on orders for coated lenses, the oldest order on file at present being dated only thirty days ago. Orders for certain focal lengths can be filled fairly promptly.

It has probably been natural to assume that with the great emphasis being placed on all defense work commercial business would lag; and to some extent this will be true. Our current program calls for a production of Super Cinephor lenses that should take care of a reasonable demand. While we may not be able to fill the order on the day it is received, I am quite sure that we will be able to do a fairly good job.

I. L. Nixon

Manager, Instrument Sales Division, Bausch & Lomb Optical Company.

I.R.E. Medal of Honor for '41 to Dr. A. N. Goldsmith

The Medal of Honor of the Institute of Radio Engineers for 1941 was awarded to Dr. Alfred N. Goldsmith, New York radio engineer, at the Annual Convention of the Institute in New York. The award was made for "his contribution to radio research, engineering, and commercial development, his leadership in standardization, and his unceasing devotion to the establishment and upbuilding of the Institute and its 'Proceedings'."

Dr. Goldsmith has been active in the radio field throughout the period of its major growth and development. He has been President of the Institute of Radio Engineers as well as President of the Society of Motion Picture Engineers. He is a Fellow of the American Institute of Electrical Engineers, of the Acoustical Society of America, of the Optical Society of America, and of other engineering and scientific organizations.

Many Accomplishments in Science

He has made numerous inventions in the fields of radio transmission and reception, broadcasting, facsimile, photographic technique, acoustical improvements (including a device for the electrical production of room resonance or reverberation); in optics (including an effective method for increasing the depth of field in photography), and in television (including methods of introducing pictured backgrounds electrically into television images, methods of using a number of small cathode-ray tubes to produce a large television image, and methods of producing advanced motion-picture effects in television programs).

Dr. Goldsmith was graduated from Columbia University, was at one time Professor of Electrical Engineering at the College of the City of New York, a consulting engineer of the General Electric Co., and a Vice-President of RCA. He is now active as a consulting engineer. In 1935 he received an honorary degree of Doctor of Science from Lawrence College, and in 1940 he received a National Pioneer Award for "distinguished achievement in the field of science and invention which has advanced the American standard of living."

Dr. Goldsmith's many contributions to the art of projection, as exemplified by his

writings in this and other industry publications, has won for him many friends within the craft. As President of the S.M.P.E. he manifested an unremitting keen interest in visual and sound projection, his view being that all that preceded the projection process would go for naught if this one final step suffered even in the slightest degree through any deficiency in either equipment or craftsmanship.

While heading the S.M.P.E., and through the years since his term of office expired, Dr. Goldsmith has never missed a meeting of the Projection Practice Committee except on those rare occasions when he was away from New York. Upon the formation of the Theatre Engineering Committee, of which he is Chairman, Dr. Goldsmith included therein the Projection Practice group as a sub-committee. His receipt of the Medal of Honor of the I. R. E. will be welcome news to his host of friends within the projection craft.—J. J. F.

DEFECTIVE VISION PREVALENT

A study in New York in 1937 and 1938 shows that of 42,500 children examined 8,560 had vision faults, according to the *Visual Digest.* Another study was recently conducted in Philadelphia jointly by the American Medical Assoc. and the National Education Assoc. They found that on the basis of a survey of 200,000 children 20 per cent of the total suffered from eye faults.

"Only a quarter of the employes of the Union Pacific Coal Co. in 1933 had normal vision, and 28 per cent had major defects of vision sufficient to require correction. A study of ten different industrial group classifications showed that the percentage with faulty vision ranges from 15 to 20 per cent in the cement, foundry, cigar and pottery industries to from 40 to 60 per cent in post offices, gas, chemical and garment industries.

"A study of the American Engineering Council in examinations of representative groups gives the percentage of faulty vision ranging up to 75 per cent for garment and paper-box workers, and finds 50 per cent or more among white collar and miscellaneous factory workers."

TWO RCA MEN PROMOTED

Two veteran RCA Photophone service and engineering men have been promoted to new positions. M. J. "Mike" Yahr, formerly Commercial Engineer at Camden headquarters, has been assigned to the newly-created position of Photophone Product Manager at the Indianapolis plant. Carl Johnson, after 11 years in the RCA service organization, has been appointed to Mr. Yahr's former position.

Method for Preventing Film Abrasion and Oil Mottle

(*Continued from page* 17)

markable degree. Although the trained eye can readily distinguish the oil, even on the lacquered film, the improvement is great enough so that most spectators would feel that the mottle is entirely eliminated.

For the evaluation of the effectiveness

of this lacquer treatment under actual trade conditions, a feature picture was placed at our disposal by Metro-Goldwyn-Mayer Co. A portion of this print was given the lacquer treatment at the time of release. The entire feature was then put into service through the Buffalo Exchange of M-G-M. At intervals the print was brought to the laboratory for examination. This allowed a comparison to be made between the untreated sample and the lacquer-treated sample in respect to abrasion and oil mottle.

Results of Field Tests

Screen tests of the two samples clearly indicated that the abrasion of the lacquered sample was considerably less than that of the untreated sample. Likewise, even though there was the same amount of surface oil on both films, the mottle on the screen due to this oil on the treated film could be detected only with difficulty; whereas that of the untreated sample was very pronounced.

When sufficient reduction of screen quality resulting from abrasion was noted on the treated samples, portions of them were retreated, i. e., the original lacquer removed in carbonate solution and a fresh coating applied. Consequently, that portion of the print which was thus retreated from time to time retained "new print quality" throughout the 35 bookings or approximately 164 runs.

It should be mentioned that the solvents employed are similar in inflammability to ethyl alcohol, and therefore all electrical equipment such as light fittings, motors, switches, etc., should be solvent-vapor-proof. Recirculation of the air in the cabinet is inadvisable. The exhaust vapors should be conducted outside the building. The solvents are similar to those used in quick-drying lacquers and finishes, and the same care should be exercised as when handling any inflammable volatile organic solvents.

Acknowledgment is made to Mr. W. D. Kelly of Metro-Goldwyn-Mayer for the use of their prints for the preliminary field tests. Acknowledgment is likewise made to Mr. J. H. Spray of the Ace Film Laboratories, Brooklyn, for the practical information gained in his plant on the use of the lacquer during the past year on color-films as well as on black-and-white negatives and prints.

DISCUSSION:

QUESTION: What is the cost of applying the lacquer?

MR. TALBOT: The cost of materials is about $0.40 for each side for each 1000-ft. roll. The labor cost will vary from almost nothing, if the lacquer is applied on the processing machine and no extra help is required to take care of it, up to $0.50 or $1.00 a roll if a special job is made of it and only a few rolls are treated.

QUESTION: Can the lacquer be applied to various types of color-film?

MR. TALBOT: The difficulty with the application to color film is that most color processes utilize dyes which are soluble either in water or dilute sodium carbonate which makes the removal of the lacquer difficult. It has been used commercially for some time by the Ace Laboratories for coating their duplitized color-prints largely for the purpose of the elimination of oil mottle, although the scratch resistance of the lacquer itself is also a factor. The new universal lacquer can be removed by an alcohol treatment, although care must be used to avoid warping the film. Experiments are under way with this new type of lacquer and the use of isopropyl alcohol for its removal from Technicolor film.

The application and removal of the lacquer

SCHINE RENEWS ALTEC PACT

The Schine Circuit has renewed an agreement under which Altec Service provides sound service, repairs and replacements, and complete theatre inspection to the 117 Schine houses. The deal was negotiated by Guy Selmser for Schine, and Bert Sanford for Altec.

by carbonate solution is entirely satisfactory in the case of Kodachrome.

QUESTION: What is the cost of equipment for applying the lacquer?

MR. TALBOT: That depends entirely upon the set-up. It is to be assumed that any processing laboratory will have equipment available, such as the stock roll, drying cabinet, and rewind mechanisms; therefore, the only special equipment is the coating unit.

The cost of this coating unit will depend on the method employed. If the simple wick method is employed for speeds of 50 feet per minute or less, the cost of the equipment will be but a few cents, i. e., a strip of clean plush, a glass rod, and a lacquer pan. If the wick method is to be employed for speeds greater than 50 feet per minute, a plush-covered driven roll is necessary. The cost of this equipment will be the cost of a small motor plus the cost of a slotted roll for holding the plush. The cost of this roll should not exceed $5.00.

For bead application the coating unit is somewhat more complicated and should be made with great precision, if the unit is to operate satisfactorily at high rates of speed. Detailed plans of such a unit are available from the Eastman Kodak Company upon request.

QUESTION: How many release prints could be made from a negative coated with this lacquer?

375 Prints from Same Negative

MR. TALBOT: The Ace Laboratories made 375 prints from a negative which had been coated on the emulsion surface with the protective film lacquer. It was not necessary to remove the lacquer from any reel during this printing. After the 375 prints were made the coating was removed and the negative appeared to be in just as good condition as before release printing began. Presumably the negative could be recoated and another 375 prints made. Possibly this cycle can be repeated many times.

QUESTION: Is it necessary to use sodium carbonate solution for the removal of the lacquer or will any alkaline developer suffice?

MR. TALBOT: Laboratory tests indicate that any alkaline developer will remove the lacquer in about two minutes and that the neutral rinse following the developer is not absolutely necessary. The use of a carbonate-formalin bath followed by a neutral rinse gives an additional factor of safety, but it is believed that the coating can be completely removed by passing the treated film through a commercial processing machine.

QUESTION: Will the removal of the lacquer by developer harm the developer in any way?

MR. TALBOT: No, we believe not. The tests that we have run indicate that there is no change whatever in the action of the developer after its use to remove the lacquer. It would be necessary, however, to run this test on a much more extensive scale and with a wider variety of developers than we have used to be absolutely sure that no effect whatever occurs.

QUESTION: Is the lacquer available in large quantities?

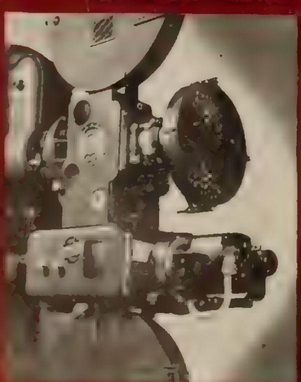
MR. TALBOT: The lacquer which the Ace Laboratories have been using for the emulsion side only is available in large quantities. The universal lacquer which is applicable to both sides of nitrate and safety films is available at the moment in sample lots only (one gallon), but unless something entirely unforeseen happens, it will be available in large quantities in a few weeks.

Thad Barrows of Boston expresses high approval of Simplex E-7

INSTALLED IN THE METROPOLITAN, BOSTON

Where *progressive* management recognizes good projection as a basic essential of efficient showmanship

E-7



METROPOLITAN THEATRE

M-P

BOSTON, MASS.

International Projector Corp.
92 Gold Street
New York, N. Y.

Gentlemen:

Here in the Metropolitan Theatre, where progressive Management recognizes good projection as a basic essential of efficient showmanship, the performance of the Simplex E-7 has earned for it recognition as one of the finest projectors ever produced.

Outstanding among the many fine features of the E-7 are the removable film trap, improved framing device, one-shot oiling system which insures positive lubrication while keeping oil off the film, shockproof gearing, heavier construction throughout, and above all, a precision intermittent movement which attains the highest degree of accuracy within my experience.

As a practical projectionist for almost thirty five years, I have always been a firm believer in the many advantages of using the newest and best projection equipment, kept in good condition at all times and operated by competent projectionists.

The E-7 represents a contribution to the advancement of the art of projection which, I am sure, is recognized and appreciated generally by the projection craft, the continuing welfare of which is so dependent upon the maintenance of the highest possible standards.

Very truly yours,

Thad. C. Barrows

Thad. C. Barrows,
Supervisor of projection.

February
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FEBRUARY 1941

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

***Edited by* James J. Finn**

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International Projectionist is not responsible for personal opinions appearing in signed articles in its columns.

Monthly Chat

RECENT experiences at legislative hearings indicate the utter futility of trying to effect passage of two-men shift bills on a state-wide basis. We're convinced by now that it just can't be done, and that the best procedure to follow is to attempt the passage of local ordinances. State legislatures are dominated by the small-town fellow (in many cases a farmer) and the topic of projection room manpower, based on technical requisites, is as far removed from his sphere of interest and understanding as is Hitler from heaven.

Local effort in this direction has been productive of much success because the craft representative knows his aldermen or councilmen and is able to talk to these fellows about his own home town.

• • •

Repair or replace? is sometimes a tough nut to crack, particularly when the boss has that w. k. tendency to economize. Still, the answer is easy when the repair cost of any given unit approximates, as do some current repair orders in a large plant, 40% of the total overall cost of new equipment, including installation. When any unit approaches such a state of disrepair it is a safe bet that it has more than earned its keep and that no matter how expert a repair job is done thereon its performance will be something less than completely satisfactory. Moreover, how long would it be before such a unit developed some other structural fault requiring the expenditure of, say, another 10 or 20% of the total replacement cost?

Projectionists have a real job on their hands in selling the boss the idea that an expenditure for repairs of 40 or 50% of replacement cost is definitely bad business.

• • •

The almost frantic effort of British technicians to "sell" the idea that mercury-vapor lamps are a suitable source of light for film projection is accorded attention elsewhere herein. American technical workers, even those with considerable experience on this development, continue to display the utmost frankness in citing the present shortcomings of this light source. Significantly, when the British claims for this unit are subject to close inspection, precisely the same conclusion is reached.

Projectionists should examine all such claims on the basis of actual performance in a projection room.

• • •

Roy M. Brewer, member of the I. A. and president of the Nebraska State Federation of Labor, has some interesting things to say anent compensation laws in this issue. Required reading.

• • •

Next Convention of the S. M. P. E. will be held in Rochester, N. Y., May 5-8, within easy striking distance of many projectionists. Make it, if possible.

INTERNATIONAL PROJECTIONIST

VOLUME XVI FEBRUARY 1941 NUMBER 2

Stereophonic Sound Reproduction

By *K. de BOER*

PHILIPS' RESEARCH LABORATORY, EINDHOVEN, HOLLAND

Recent demonstrations by both Bell Telephone Laboratories and RCA Manufacturing Co. have induced widespread interest in ways and means of effecting the stereophonic reproduction of sound-films. Some of the more important factors incident to the solution of this problem are described briefly in the appended excerpts from a recent exhaustive and rather complicated communication from the Philips' Research Laboratory. These data serve as interesting background material anent this modern reproduction process.

AN ESSENTIAL part of our perception of sound is a space impression as to the origin of the sound. When for some reason or other the perception of direction from which a sound comes is lacking we often experience an uncomfortable feeling, a feeling of disquietude.

The original function of our sense of hearing may be considered to be that of warning us against danger. This is in agreement with the fact that although we possess eyelids we have no "earlids"; in other words there is no provision for temporary suspension of hearing at will, since danger may always be lurking. A warning of danger can, however, only be useful to the hearer when his ear also perceives from what direction the danger comes, and to some extent also how close it is.

Sounds which have nothing to do with any danger are also customarily associated with a position in space. If there are several sources of sound, such as the different speakers in a play, we distinguish between them by means of directional hearing, and we take it for granted that the acoustic and the visual perceptions agree. In the same way our impressions in listening to a concert performed by a large orchestra are very much influenced by the fact that we hear the sound from the separate instruments coming from different directions, and can identify them not only by their timbre but also by the direction from which the sound comes.

Directional Hearing Aspects

This faculty of being able to identify a particular sound when it is accompanied by a large number of other sounds is itself a very important result of directional hearing. We are able to concentrate our attention on the sound from a certain direction, and in this way to put into the background of our consciousness sounds from other directions which are disturbing or undesired at the moment.

All these phenomena in our sense of hearing are nullified in the ordinary electro-acoustic methods of sound amplification and transmission now in use. When we listen at home to a radio broadcast of a concert we hear all the instruments from one direction only—that of the loud speaker. The plastic element of the orchestral music is lost.

In listening to a radio play the hearer must depend mainly on differences in timbre (and possibly in intensity) in order to distinguish among the different voices. If several persons speak at the same time, or if there are extraneous sounds, it may become very fatiguing for the listener to concentrate his attention on one of the voices without the support of differences in direction. This fact must be taken into account by the director of the play.

Anent Localized Hearing

In sound reproduction in the movie theatre the lack of a directional effect may also be felt. One sees a player move across the screen, for example, but his voice continues to be heard from the same direction, namely that of the loud speaker set up behind the screen. Bearing in mind that in the development of the film industry there is a continual striving toward a greater degree of "naturalness," it is clear why attempts are made to make the illusion more perfect by making it possible in reproduction to distinguish by ear the

different positions of the source of sound in the original recording.

For localizing a source of sound with respect to an observer three coordinates are needed: the distance, the direction in the horizontal plane (azimuth) and the angle to this plane (height). There is little to say on the latter point: we have practically no direct perception of this factor. The impression that a sound comes from above is gained mainly by tilting the head, and thus this perception is reduced to that of a direction in the "horizontal" plane.

The perception of distance has not yet been entirely explained theoretically in every case. In enclosed spaces it is explained by a variation in the relation between the direct sound (which reached the observer without reflection) and the echo or reverberation. When the distance of the source of sound changes, the intensity of the direct sound varies, while that of the reverberation remains approximately constant.

By far the most important feature in localized hearing is the perception

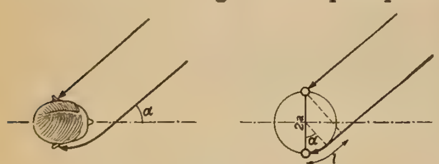


FIGURE 1

Sound coming from a direction which makes an angle A with the vertical bisecting plane of the head reaches the two ears with a time difference. The wave which bends around the head is also weakened

of direction in the horizontal plane. This depends upon the collaboration of both ears. (Fig. 1). If the source of sound is situated in the perpendicular plane bisecting the line joining the two ears, the latter receive exactly the same impressions. When, however, the sound comes from a direction *a*, it first reaches one ear, and only after a certain length of time the other, while, moreover, due to bending around the head of the observer it is somewhat weakened. Our centre of hearing is extraordinarily sensitive to these differences in time and intensity, which, led by experience, it interprets as angular deviations from the bisecting plane.

In order to retain the impression of direction in electrical transmission of sound, the sound must be delivered to the two ears of the listener with the correct relative time and intensity differences.

Movie Theatre Requisites

In a movie theatre a large area is actually occupied by the audience. It is clear that for different positions the perception of direction in stereophonic reproduction will be quite different. In order to obtain a general idea, we have carried out a number of listening tests, the results of which are given in Figs. 2 and 3.

For the three places *2*, *3*, *4*, which are indicated in Fig. 2, Fig. 3 shows how the "sound image" moves, if, for the listener at place *1*, it shifts over a given distance of the screen. For seats more to one side the "focussing" shrinks, the "sound image" moves a shorter distance than the speaker.

In the shaded region in Fig. 2 the "focussing" has shrunk so much that the listeners in these seats observe practically no stereophonic effect at all. By the arrangement of the loud speakers at opposite sides of the screen with the greatest possible distance between them, the shaded portion of Fig. 2 is restricted as much as possible.

Angle of Sound Radiation

In order not to make the intensity differences confused, it is advisable that the sound radiation of the loud speakers should be constant within the angle at which the loud speaker faces the audience. Outside this angle the loud speakers should radiate as little sound as possible, since this sound reaches the audience after one or more reflections in the form of reverberation, by which the sharpness of the sound image is unfavorably affected.

The two amplifiers and loud speakers which are used in reproduction may not differ in quality of reproduction. Otherwise there is a tendency for the listener to interpret the differences in quality as an indication of direction, *i.e.* to concentrate his attention in the direction of the better loud speaker.

In sound reproduction in theatres use is at present commonly made of separate loud speakers for the high- and low-frequency ranges (above and below about 300 c/sec, respectively). It is subject to convincing proof that tones with

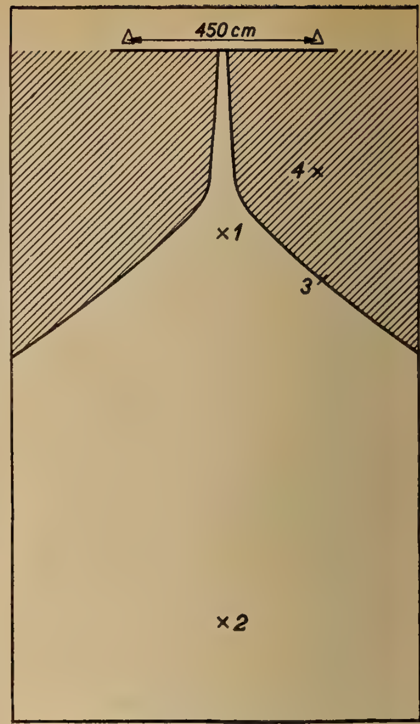


FIGURE 2

In the seats situated in the shaded regions the listener observes a maximum displacement of the "sound image" over only half the width of the screen, so that the stereophonic effect is not sufficient here

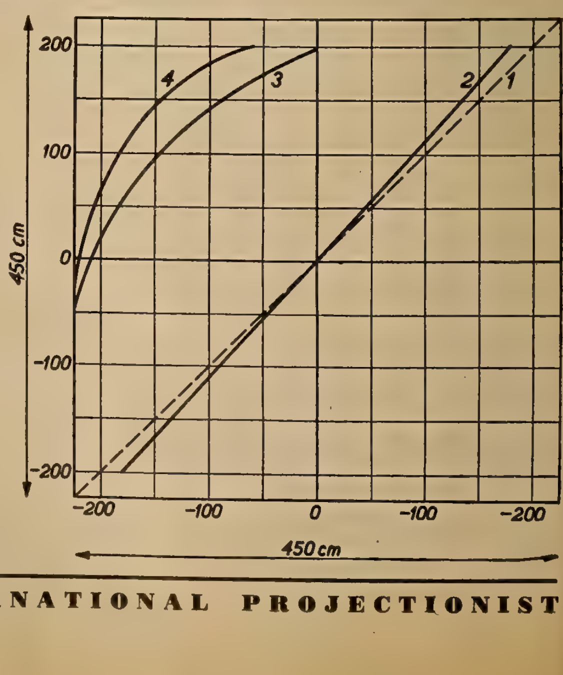
frequencies below 300 c/sec are practically incapable of arousing any perception of direction. Therefore, for stereophonic reproduction it is only necessary to set up two loud speakers for the high tones at either side of the screen, while the low tones can be reproduced by a single loud speaker placed at any desired position, for instance, behind the middle of the screen.

RENEW BUTTERFIELD-ALTEC PACT

W. S. Butterfield Theatres has renewed contracts with Altec Service for 96 houses in Detroit and other Michigan cities. F. C. Dickely negotiated for Altec.

FIGURE 3

If the "sound image" for the listener at place 1 in Fig. 2 is displaced over the whole length of the screen, the listeners at places 2, 3, 4 in Fig. 2 only observe the displacement of the "sound image" indicated as ordinates in the figure



Looking at the sound picture  **from the projectionist's port-hole**

SILENT WATCHMAN of PHOTOCELL VOLTAGES

The RCA 874 Voltage Regulator Tube is just what the name implies. It makes possible the automatic regulation of circuit voltages in a convenient, dependable and scientific manner.

The RCA 874 is employed in RCA Photophone equipment as a "silent watchman" of polarizing voltages which are supplied to the photocells. By effectively doing its job of regulation, the RCA 874 provides for a more stable photocell output, longer photocell life, and reduces the possibility of ionization within the photocell.

The "silent watchman" is consistently on guard and functions without fanfare. Yet its use contributes to greater improved over-all equipment performance. It is one more way that RCA helps you provide finer performance for theatre patrons.

RCA VICTOR PREFERRED TYPE RADIO TUBES
For Finer Radio Performance

Better sound means better box office — RCA Tubes mean better sound.

AT YOUR SERVICE

RCA Photophone field engineers are always ready and eager to serve you. Backed by RCA research and experience in sound recording and reproduction, the engineer near you will be happy to help you with any problems you may have—and in addition, solicits your suggestions and criticisms for further improvement of RCA Photophone Equipment—the best in the business!

RCA THEATRE SERVICE

PHOTOPHONE DIVISION

RCA Manufacturing Company, Inc., Camden, N. J.

In Canada, RCA Victor Co., Ltd., Montreal — A Service of the Radio Corporation of America

An Improved Trouble-Shooter for Audio Amplifier Work

By *CALVIN E. MERVINE*

MEMBER, I. A. LOCAL UNION 218

THE original model of this instrument* was extremely compact in its assembly, but, like a midget radio, it was extremely difficult to service. The instrument shown in the photographs is the rebuilt job, and was designed to facilitate construction and any servicing that may be necessary.

A few minutes study of the pictures will fix the placement of the parts and will aid in setting up the parts layout. The pictures show the location of the parts belonging on both the chassis and the front panel. Note that each part has been so positioned that it may be replaced with relative ease, if necessary. Electrolytic condensers and tubes are the parts most frequently replaced, thus special attention has been given to them.

Rubber grommets have been used where wires pass through the chassis. This prevents accidental abrasion of the insulation by the sharp edges of the holes. The audio tube socket, too, is mounted on extra-live rubber grommets. Most of the mechanical shock and vibration is thus eliminated, the method used being plainly shown in the photographs.

*"An Instrument for Trouble-Shooting in Audio Amplifiers," by C. E. Mervine, *Int. Proj.*, October, 1940, p. 13.

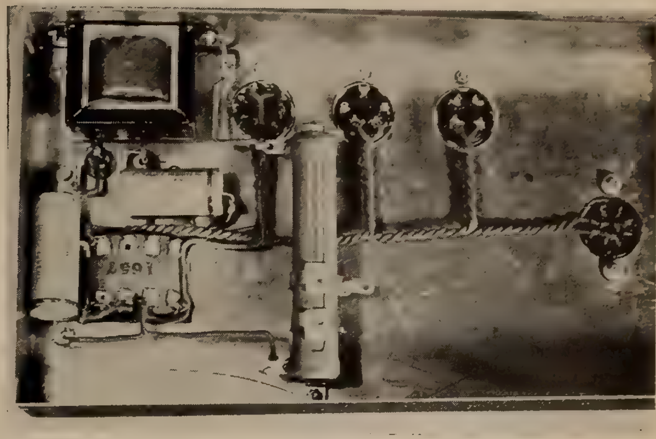


PHOTO A

This and succeeding photos illustrate the development of the job as construction progressed

The steel cabinet is sufficiently large to provide ample room for the parts and chassis. The cabinet size is 16" x 8" x 8"; the chassis is 13" x 7" x 2". All parts should be on hand before any holes are drilled. This will eliminate the possibility of parts failing to fit in their allotted space. The supply dealer will test the parts as they are purchased, if requested.

The resistors marked 1% tolerance are seldom carried in stock by dealers but may be obtained direct from Continental Carbon Co., Cleveland. Certain other resistors and capacitors are not critical in their values, and the veteran experimenter will spot them immediately. The beginner had better follow the parts list as published.

The front panel and the top of the chassis should be covered with a sheet of plain paper, held in place with several strips of scotch tape. The surface of the paper is easily marked for drilling and punching operations, and also acts as a protection against accidental scratches on the finished surfaces. Center-punch the markings through the paper, and then drill the holes, leaving the paper in place until the metal work is finished.

Chassis and Mounting

The chassis parts were mounted and the tube heaters wired-in with tightly twisted hookup wire before the front panel was fastened to the chassis. The holes were then drilled in the front panel and the panel parts then mounted into place. All parts were checked again for possible damage in handling.

The meter should not be mounted until the instrument is completely wired, as the pivots or jewels may be damaged by jarring and the meter ruined. Note that for certain test purposes the meter may be temporarily installed on the panel, but for safety's sake it should

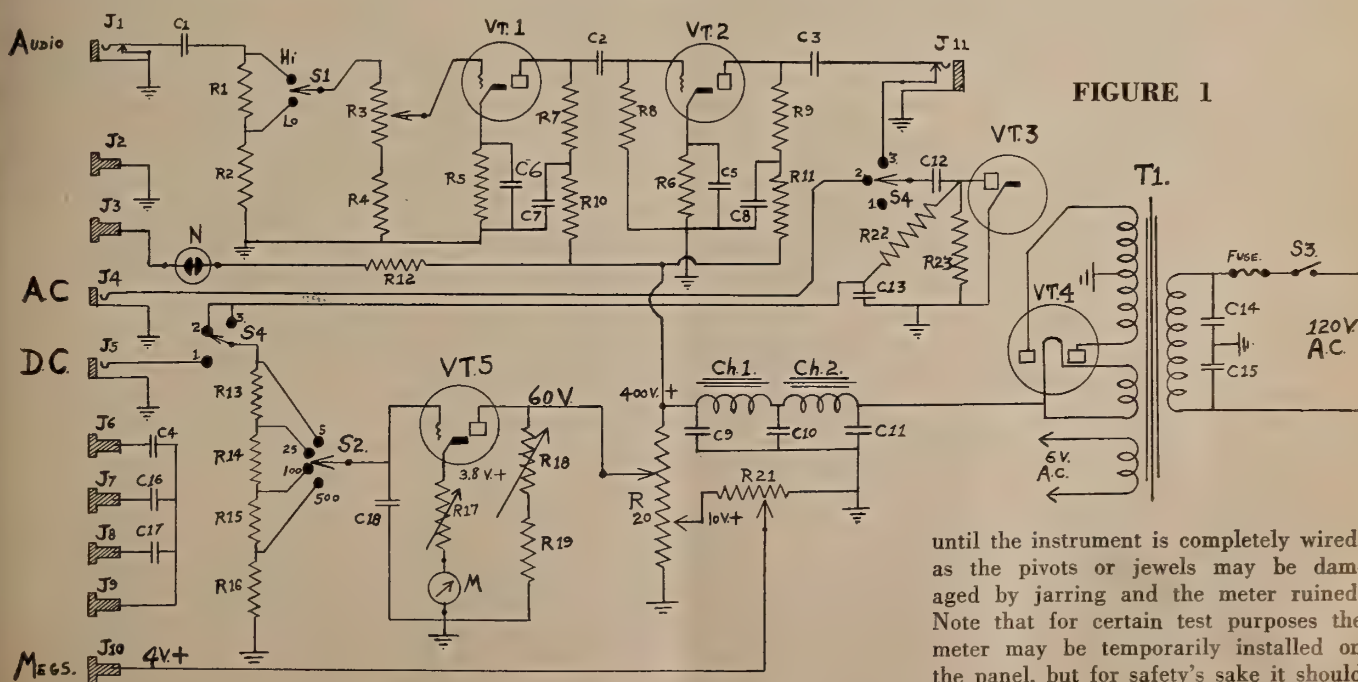


FIGURE 1

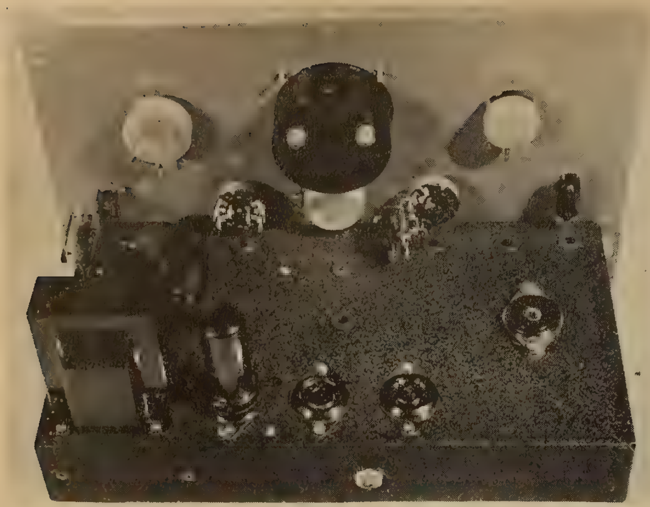


PHOTO B

PHOTO C

be removed when the tests have been completed.

If flexible leads are used between the VTVM range switch and the associated resistors R-13, R-14, R-15 and R-16 as a means of temporary connection, it will be rather easy to substitute various values of resistances to enable correct calibration. When all voltage ranges are correctly calibrated, the resistors chosen may then be mounted directly on the terminal lugs of the VTVM range switch. Personal preference may determine the balance of the wiring. Thorough check of the completed wiring is imperative.

Insert all the tubes in their sockets and turn on the instrument. After allowing sufficient warm-up time, the plate and heater voltages should be checked. The 7F7 plate voltage is 200 volts, and the cathode voltage is 2.6 volts. The 76 plate potential is 60 volts, and its cathode bias 3.8 to 4 volts. The voltage readings found will indicate the corrective steps to be taken, if any. All voltages are specified with reference to chassis ground, measured with a 2000 ohms-per-volt meter.

Apply a D.C. voltage from a small "B" battery to the input of the VTVM probes and note the positive reading on the meter scale. Reverse the two probe connections at the battery and note the negative reading on the meter. The two readings should be equidistant from the zero center of the meter scale. If they are not equidistant, then readjust the resistors R-17 and R-18 until the tube is operating on the straight portion of the grid-voltage plate-current characteristic curve. When this point is reached the two readings will swing the needle on both sides of zero center in an equidistant manner.

[Note: The first half of the negative side of the scale, going from zero center toward the extreme left end of the scale is linear; but the remainder is not. This is artificially corrected on cetrain commercial meters by printing the divisions on the extreme left portion of the scale closer together than the rest.]

An example will clear the point under discussion. A positive potential of 20 volts applied to the VTVM probes will read 20 volts on the positive side of the scale. The same voltage applied with the VTVM probes reversed will read about 17 volts on the normally spaced scale, but on the artificially crowded scale the voltage indicated would be 20 volts. This apparent error is mentioned so that the builder will not try to make both sides linear, as this is impossible.

Incidentally, the needle of the front panel meter is set to exact zero center of the scale by adjustment of R-18.

The circuit in Fig. 2 will supply the variable voltages needed to calibrate the VTVM. Do not attempt to use series resistors to drop the voltage, as the VTVM sensitivity will nullify their presence.

The megger voltage chosen was 4 and is obtained by moving the bottom slider in Fig. 1 along the bleeder resistor R-20 until a rough value of 10 volts is found. The exact setting of 4 volts is made with the potentiometer R-21. Calibration of the megger was described in the October issue of I.P.,* and needs no further comment.

The audio Hi-Lo switch ratio of 100 to 1 is not mandatory and the builder may use any ratio he elects. The level potentiometer may be calibrated in either decibels or in some arbitrary units of comparison. For exact stage gain measurements the calibration should be made as accurately as possible. For rough checks the calibration need only be an approximation. Here is the method used by the writer:

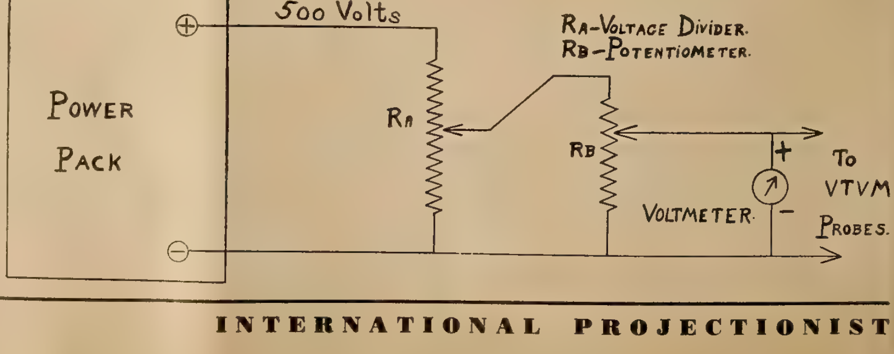
With a 49-C amplifier in operation, and a test loop or audio oscillator supplying a signal, the 713-A fader is adjusted to a low setting and the audio probes are applied to the input terminals of the 46 amplifier. The meter reading with the instrument gain wide open is noted. Be certain that the signal is not overloading the instrument.

The fader was moved up one step, or 3 decibels, the audio level potentiometer was backed off until the original reading was obtained, and the panel was marked at this setting. The fader was advanced step-by-step and the previous process gone through until the entire range of the level control was covered. Some similar method may be used if the builder does not have access to this type equipment.

A spare four-prong socket was mounted on the rear lip of the chassis to be used to supply plate and heater voltage to some future designed gadget, *via* a plug and cable arrangement. It may also be used to supply "B" voltage to a head amplifier in an emergency.

A steel panel 12 x 4 inches was

FIGURE 2



This largely depends upon your equipment, and particularly your projection equipment, for after all, it is the picture on your screen which you are merchandising.

One of the most radical changes in years occurred with the introduction of the 19,000 Series.

Simplex HIGH

INTERMEDIATE CAPACITY PROJECTION ARC LAMP HOUSE

and associated rectifier equipment. It marked the passing of low intensity projection and the advent of deluxe projection in those medium sized houses which heretofore had been deprived by prohibitive operating costs of brilliantly projected pictures and correct color rendition.

The Simplex High is a low-cost arc designed especially for theatres of up to 800 seats and using screens as large as 18 feet in width. It projects twice as much light as the low-intensity, a snow-white light, characteristic of the high-intensity arc, which is so necessary to the projection of colored pictures. Yet, the overall operating costs are only slightly higher because this arc operates at only 27 volts as compared with 55 volts in the low-intensity, and each 14-inch, 7 mm. Suprex positive carbon burns for at least two hours.

Distributed by= **NATIONAL THEATRE SUPPLY COMPANY**

"There's a Branch Near You"

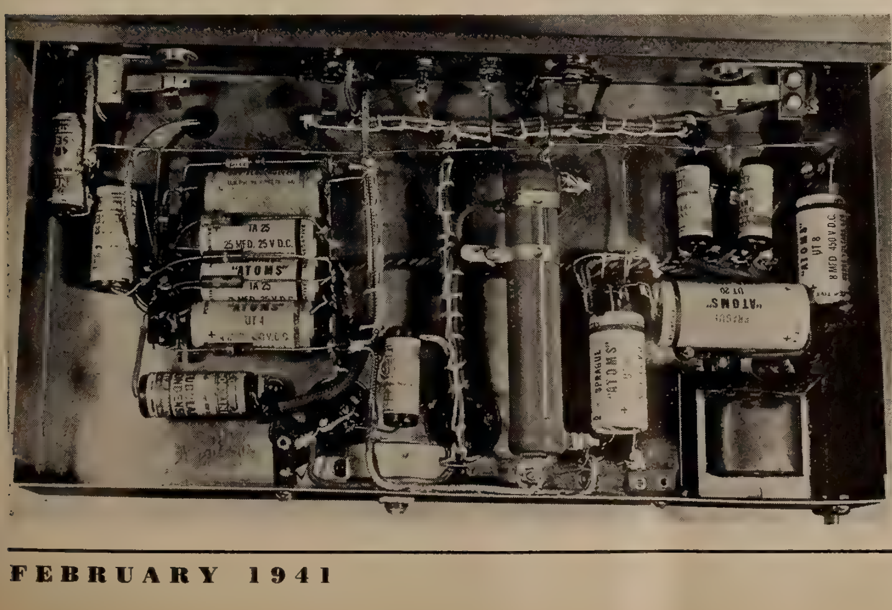
suspended from the lid of the cabinet with four threaded rods each 2 inches long. On this sub-panel is mounted a condenser leakage test unit for checking paper, mica and oil-impregnated condensers. An ohmmeter is mounted there for measuring low and medium values of resistances. Finally, there is a condenser substitution unit containing three values of capacity ready for instant use.

The ohmmeter is a small commercial job and was refitted on this sub-panel for two reasons. First was an inability to procure a suitable meter scale for the front panel meter that would read both as a zero-center voltmeter and a dual-scale ohmmeter. If such a scale had been obtainable, the writer should have used the meter on the front panel as a combination ohmmeter and voltmeter. The second reason is simply a matter of appearance: the round face on the ohmmeter does not harmonize with the square face of the voltmeter, so it was mounted where it is not in constant view.

The neon lamp in the leakage tester is a two-contact, bayonet-based type. A quarter-watt lamp, it is made for condenser checkers and contains no resistor built into its base as do most small neon lamps. The test cords for this sub-panel are ordinary red and black, with similar colored prods terminated with alligator clips. The neon circuit may be used for quick continuity tests. The current flow through the circuit is only 1.4 milliamperes on a dead short-circuit.

In testing condensers for leakage an ohmmeter is worthless, since the small self-contained battery in the ohmmeter does not test the capacitor under actual operating conditions. The cords are inserted in the jacks marked "leakage," and the alligator clips are fastened to the condenser under test. There will usually be a charging flash of the neon

PHOTO D



Parts List For Audio Trouble-Shooter

All numbers referred to, and letters, are from Figure 1.
All resistors ½-watt type except where otherwise indicated.

R1: 5,000,000 ohms, 1%
R2: 50,500 ohms, 1%
R3: 2,000,000-ohm pot.
R4: 20,200 ohms, 1%
R5, R6: 3,000 ohms
R7, R8, R9: 200,000 ohms
R10, R11: 10,000 ohms
R12: 250,000 ohms
R13: 8,000,000 ohms, 1%
R14: 1,500,000 ohms, 1%
R15: 400,000 ohms, 1%
R16: 100,000 ohms, 1%
R17: 10,000-ohm pot.
R18: 25,000-ohm pot.
R19: 4,000 ohms, 2 watt
R20: 50,000 ohms, 50 watt
R21: 10,000-ohm pot.
R22: 1,000,000 ohms
R23: 20,000,000 ohms
R24: 1,000,000 ohms 1% (in probe)
J1, J11: closed circuit, phone-type jacks
J4, J5: open circuit, phone-type jacks
J2, J9: black banana-type jacks
J3, J6, J7, J8, J10: red banana-type jacks
Vt1, Vt2: 7F7 type tube
Vt3 1V type tube
Vt4: 80 or 5W4 type tube
Vt5: 76 type tube
C1, C2, C3, C4: 0.1-mfd. paper
C5, C6: 25-mfd., 25-volt 'lytic
C7, C8: 4-mfd., 450-volt 'lytic
C9, C10, C11: 8-mfd., 450-volt 'lytic
C12, C13, C14, 15: 0.02-mfd. paper
C16: 0.5-mfd. paper
C17: 12-mfd., 450-volt 'lytic
C18: 100-mfd. mica
Ch1, Ch2: 15 to 40 henries
T1: medium size trans. 6v. fils.
N: ¼-watt neon lamp
M: 0 to 1 mill. meter
Sw1: S.P.D.T. toggle
Sw2: S.P. 4-position rotary
Sw3: S.P.S.T. toggle
Sw4: 2-pole, 3-position rotary
Fuse: 2 amp. max.
12 ft. shielded mike cable
12 ft. flexible test cord

Cabinet, sockets, wire, probes, clips, solder and miscellaneous hardware.

lamp and the lamp will then be extinguished. If the flashing continues at a rate greater than one flash every second, the capacitor is defective.

Plate-to-grid coupling condensers should not flash the neon lamp more often than one flash every ten seconds. A steady glow of the lamp indicates a shorted condenser.

If the condenser be small in capacity, the charging flash will be difficult to detect or may even be invisible. The lack of the charging flash may be due to the capacitor being open-circuited. This is easily checked by removing the clips from the condenser while the current still is turned on. The condenser terminals are now shorted with a screw driver, and if the condenser be open, there will be no discharge spark obtained.

If the condenser be small, the spark will also be small, and close observation may be needed. [Note: On D.C. only one electrode in the neon lamp glows, the other remaining dark.]

Megger Calibration Chart

Volts readings	Megohms
4	0
3.3	2
2.9	4
2.5	6
2.2	8
1.7	10
1.3	20
1.0	30
0.8	40

The three red banana jacks along the left edge of the sub-panel are the terminals of three fixed condensers. Two of these condensers are of the paper type, having a value of .1 mfd. and .5 mfd., respectively. The third condenser is an electrolytic type of 12 mfd. capacity. Other values of capacitors may be installed, if deemed desirable.

The negative and outside foil ends of these three condensers are terminated

on a single black banana jack. This jack is not at ground potential. The test cords are plugged into the value needed and applied to the circuit under observation, with particular emphasis on the proper polarity in the case of the electrolytic.

When a condenser open-circuits in an amplifier, the circuit usually developes a bad hum or the amplifier may begin to "motorboat." In case the capacitor is in a plate-to-grid circuit, the amplifier will go dead. The convenience with which any one of these three condensers may be inserted into a circuit certainly warrants their installation on the sub-panel. The leads should be shielded "mike" cord if the condenser is to be inserted as a plate-to-grid coupling unit, since unshielded leads may cause hum pickup or even oscillation.

When the hinged lid is closed, the entire sub-panel fits into the heart of the instrument and is out of the way until needed. All voltages needed for operation of the sub-panel units are obtained by means of a three-wire cable plugged into a three-prong miniature socket mounted on the chassis. This allows the sub-panel assembly to be quickly removed without touching the chassis and front-panel assembly; and *vice versa.*

The audio probe and cable is used in making voltage readings in 60 c.p.s. A.C., just as it is used in the audio frequency checks. The ground probe is attached to the ground or neutral line, if one is checking power lines. The placement of the two probes is not very important if one is checking A.C. tube filament leads where a power transformer isolates the power line from the low voltage secondaries.

R-22 is an experimental value that gives the proper readings on the meter in my instrument. If necessary, this resistor should be adjusted in value until the A.C. readings on the meter are correct.

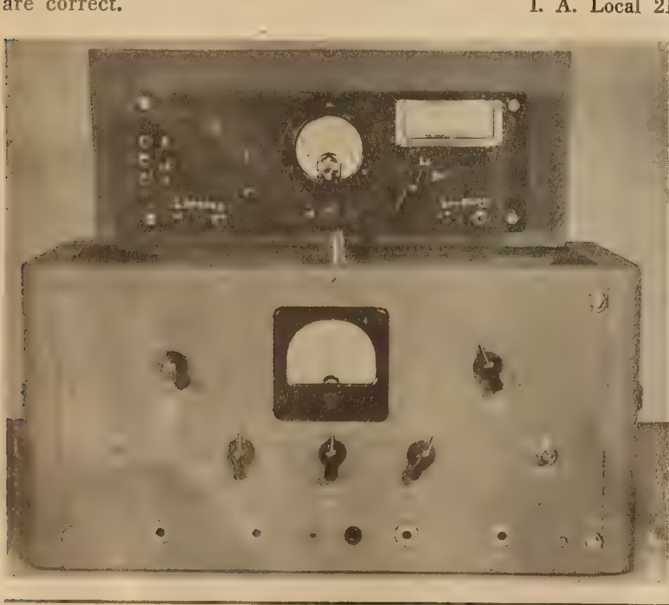


PHOTO D

The completed trouble-shooter makes a good-looking, rugged, compact job that is easy to service

• Letters to the Editor •

SIGNO-MARKER EFFECTIVENESS IS DISCUSSED CON AND PRO

To the Editor of I. P.

FOR sometime now I've wanted to express my views regarding the desirability of using, and the general effectiveness, of the Signo-Marker, made by Clint Phare Products, of Euclid, Ohio, and which has been advertised in several issues of I. P. I am in complete agreement with the heading of this ad, which goes like this:

"STOP! Mutilating Film with Scratches"

To me, and to a few other projectionists, this is exactly what Signo-Marker *does* to film. Would you please inform me how any projectionist working in a suburban theatre can ever again hope for good print condition if all the boys use Signo-Marker? Isn't it a fact that practically all projectionists affix their own individual cues to the film, regardless of any previous markings thereon?

Print conditions that we encounter are so bad as to strain belief. Isn't it a fact that, if china pencil or crayon be used, any number of film markings can be wiped off and still leave a clean picture? I just can't see the sense to utilizing artificial lighting or an artificial moon (punchholes). As long as the film is scratched that particular marking cannot be removed unless the film be cut, which procedure is not always feasible because of dialogue on the track.

A crayon marking as big as the picture itself certainly should be visible to anybody; moreover, it does not damage the image and can be wiped off whenever one desires. Of course, it is to be expected that the exchange would remove such markings between the various runs. I feel sure that a good crayon marker, possibly to be applied by some such device as the Signo-Marker, would sell. How about it, boys?

A. Kuiper
I. A. Local 219, Minneapolis, Minn.

To the Editor of I. P.

THE phenomenal success scored by Signo-Marker to date might be cited as the most effective reply to Mr. Kuiper; however, his letter is most welcome because it provides an opportunity to tell our side of the story. I regret that Mr. Kuiper did not mention in detail film conditions as he finds them, because this might put to shame those projectionists (?) responsible for the most flagrant mutilation. During my 23 years in this business I have seen every type of it.

True, the Standard Release Print was decidedly a step in the right direction, but I don't believe that even Mr. Kuiper will aver that it solves the problem of muffed changeovers due to hard-to-see black dots, many of which appear in dark areas, to say nothing of the extreme eyestrain experienced while waiting for the cue dots to show up. Signo-Marker was made expressly to compensate for the shortcomings of the cut markings in the S. R. P.

I agree with Mr. Kuiper that many projectionists still place their own markings on the film (utilizing all manner of markers), which fact is conclusive proof that the S. R. P. cues are unreliable because they are *not* standard as to shape or position. The projectionist, desiring to protect himself, places a cue mark on a spot which he feels is in the right position. I personally believe that if S. R. P. cues were to be relied upon, no projectionist would bother to make individual markings on film.

Signo-Marker Does Not Perforate

As for grease-pencil marks, they might serve in the absence of something better, but such a marker would hardly overcome the problem of missing a cue which appeared on a dark-background scene. If Mr. Kuiper had proceeded further in quoting our ad, he would have noticed a reference therein to "grease-pencil and other unsightly marks." Many projectionists consider pencil blotches, as large as the picture itself, to be poor projection, to say the least.

Regarding artificial lighting effects—articial moon, punch holes, etc.—we must bear in mind that film stock is fairly delicate. If Signo-Marker is used correctly, it will not punch through the film but will leave a tiny, transparent circle in the standard dot position. It requires only a little practice to make Signo-Marker effective with a minimum of pressure being needed.

More than 1600 Signo-Markers have been sold to date throughout the U. S., in Canada, and in several foreign countries, with many noted projectionists among the purchases of large blocks for circuit theatres. It is a bit difficult to conceive of these 1600 projectionists all being wrong. I am positive that a thorough trial of Signo-Marker by Mr. Kuiper will result in his joining their ranks.

Clint Phare
Clint Phare Products, Euclid, Ohio

Mercury-Vapor Lamp Characteristics

By *H. K. BOURNE*

B. T. H. RESEARCH LABORATORY, RUGBY, ENGLAND

Further light is shed on the present status of the high-pressure, mercury-vapor discharge lamp with respect to its possible use in the motion picture field by the publication in England of a paper by H. K. Bourne, of the B.T.H. Research Laboratory at Rugby†. Two types of discharge lamps—the air-cooled and the water-cooled—are discussed in this paper, some of the more significant passages in which are appended hereto.

IN ORDER that electric discharge lamps may be suitable for projection they should have a high intrinsic brilliancy and a source of such a shape that the light may be collected efficiently without requiring an elaborate optical system. The only type of discharge lamp which satisfies these requirements at the present time is the high-pressure, mercury vapor type.

The brightness of the source is determined by the wattage loading per unit length in the arc column. An increase of this loading produces a higher temperature of the arc tube. This corresponds to a higher mercury vapor pressure and a reduction in the size of the light source for a given wattage of lamp. The efficiency of the lamp tends to rise with increasing pressure and so, as the light source also decreases in size, the brightness will become greater. Hence the brightness of the lamp increases when the wattage per cm. in the arc is increased.

The maximum operating temperature of the lamp is governed by the softening temperature of the material from which the arc tube is made. In the case of a glass lamp (termed Type MA) the internal pressure of the mercury vapor is approximately 1 atmosphere‡ and the glass operates at about 550° C. If higher loadings are used, corresponding to a higher temperature of the arc tube, then, instead of glass, it is necessary to use quartz, which has a much higher softening temperature. The arc tube of quartz lamps may operate at a temperature exceeding 1,000° C.

Pressure Considerations

As the wattage of the high-pressure mercury vapor glass lamp is reduced, the efficiency falls rapidly, but it rises as the operating pressure is increased, thus low-wattage lamps of high efficiency may be made by using quartz envelopes with a high internal pressure of mercury vapor. For example, a quartz lamp of 100 watts operating at about 10 atmospheres pressure has an efficiency of 40 lumens per watt; whereas a similar lamp made in glass, operating at approximately 1 atmosphere mercury vapor pressure, would have an efficiency of only 30 lumens per watt.

The higher pressure is obtained by raising the temperature of the arc tube, which is accomplished by reducing its diameter and length. The size of the arc is thus reduced, and so its brightness is increased. A lamp of this type (termed Type MB), in which the arc is not brighter and its linear source shape not as suitable as that of a filament lamp for use in an optical system, is not particularly satisfactory as a projection source except for a few special cases.

The air-cooled Type ME lamp is often known as the "compact source" lamp by reason of its short, comparitively wide arc (Fig. 1). The lamp consists of a strong quartz bulb with walls several mm. thick, approximately spherical in shape, into which are sealed two solid cylinders of tungsten known as the main electrodes which are supported on tungsten shanks. On each of these shanks is wound a spiral of tungsten wire, coated with an emitting material, which is known as the starting electrode.

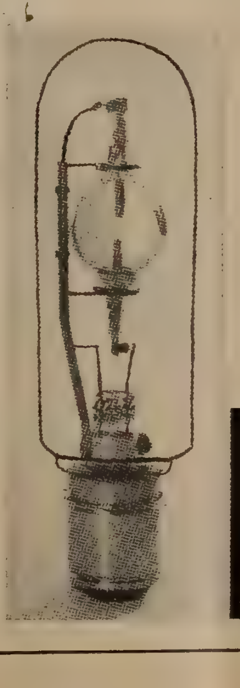
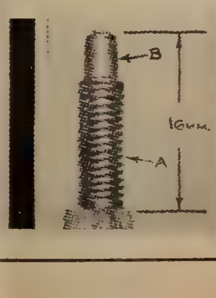


FIGURE 1

Left: 500 - watt compact source high - pressure, mercury-vapor lamp

Below: electrode system of 500-watt compact source lamp



An auxiliary electrode of bare tungsten wire is sealed into the bulb with its end adjacent to one of the starting electrodes and spaced about 1 mm. from it, and connected through a high resistance outside the bulb to the other terminal of the lamp. The arc gap measured between the two main electrodes is approximately 5 mm. long.

The bulb contains a filling of argon at a low pressure and a weighed quantity of mercury, the amount depending on the size of the bulb and the voltage-drop required. The current is led into the main electrodes through molybdenum foil strips only 0.6 mil thick, which make a vacuum-tight seal in the quartz. Considerable preliminary work had to be done on the development of seals in quartz before it was possible to employ quartz for lamp construction, and it was not until the technique of making such seals had been perfected that the high-pressure lamps could be developed. Seals capable of carrying 100 amps. into electrodes in a quartz bulb may now be made.

Air-Cooled Lamp Operation

The lamp is supplied from A.C. mains through a reactance in series with it which limits the current to a suitable value. When the supply is switched on, a discharge of a few milliamps. takes place across the short gap of about 1 mm. between the auxiliary electrode and the starting electrode. This causes ionization in the gas and produces enough emission from the adjacent starting electrode to enable the main arc discharge to strike between the starting electrodes of the lamp.

This main arc discharge operates initially in the argon filling. The heat generated by this arc in argon causes the mercury to vaporize. The pressure of the mercury vapor gradually rises as the lamp warms up. The voltage drops across the arc, which is initially only about 10 volts, rises as the pressure builds up. The arc current heats up the main electrodes, and after a short time when the pressure has reached a certain value the arc changes over to the shorter path between them.

After this time, the starting electrodes play no further part in the operation of the lamp, which warms up until all the

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†"Characteristics of Electric Discharge Lamps for Projection," by H. K. Bourne, *J. Brit. Kinematograph Soc.*, January, 1941.

‡1 atmosphere = 14.2 lbs. per sq. inch.

mercury has vaporized. It then operates at its full wattage and voltage drop of about 70 volts, and the light source, which is now a steady arc between the main electrodes, is giving its maximum luminous efficiency and brightness. The process of attaining the steady state takes some minutes, and is known as the "run-up" time.

If a lamp which is operating is suddenly extinguished due to the supply being interrupted, it will not re-strike immediately, as the striking voltage necessary when the mercury vapor is at the full operating pressure of 20 to 40 atmospheres is many kilovolts. It is necessary for the lamp to cool down, and when the mercury vapor pressure has fallen sufficiently the lamp will re-strike and will run up once more. This delay time, known as the "re-striking" time, may be some minutes, depending on the conditions in which the lamp is operating.

Due to the fact that the lamp operates with a high internal pressure of mercury vapor of many atmospheres, the bulb is normally subjected to a considerable stress, and if a fault in the control gear develops, causing the lamp to operate at a value considerably higher than its rated wattage, the bulb may break with considerable violence and fragments of hot quartz may be projected for some distance from the lamp.

Severe tests and careful design ensure that the chance of breakage under pressure is so remote a contingency as to be almost negligible. However, it is advisable to operate this type of lamp inside a housing which will protect flying fragments of quartz from injury to personnel or surrounding apparatus in the event of an "explosion" taking place.

TABLE A

Approximate brightness of sources

Source	Approximate Brightness (Stilb)*
Tungsten filament general lighting service lamps ...	100—1,000
Tungsten filament projector lamps	250—2,000
Pure carbon arc	10,000—25,000
High intensity carbon arc	50,000—100,000

*Candles per sq. cm.

Air-Cooled Lamp Sizes

The Type ME lamp may be made in sizes covering a range from 100 watts up to many kw. For the smaller sizes of lamps up to 1000 watts the quartz bulb is generally sealed into a boro-silicate glass jacket which provides some heat insulation and prevents draughts from blowing on the bulb, which would cause mercury to condense and thus make the lamp unstable in its operation. This outer jacket is filled with an inert atmosphere of a mixture of argon and nitrogen which protects the seals in the quartz from oxidization. The outer jacket is fitted with either a pre-focus or a screw cap.

The lamps will operate with a reactance ballast from an A.C. supply of 200 to 250 volts. They will also operate stably from a 100-volt supply, but such a low value of mains voltage is insufficient to strike the arc initially and an auxiliary device, such as a Tesla coil, must be used; or the arc may be struck by applying a high-voltage impulse.

The lamp will also operate satisfactorily from a D.C. supply of 100 volts and above with resistance ballast. In this case a special method of starting is required, and one such method is to use a small inductance in series with the lamp, and a mercury switch connected across the lamp. On opening the mercury switch a high-voltage surge is produced which causes the lamp to strike.

The brightness distribution of the source in the air-cooled Type ME lamp is almost constant over the central region of the length of the discharge, but rises to a very high value in the vicinity of each electrode. These regions of extremely high brightness are too small in size to utilize in any practical optical system. Across the arc, the brightness falls from a high value in the central core of the arc to zero at the edges.

Water-Cooled Type Lamp

The water-cooled high-pressure mercury vapor lamp, known as the Type MD/H, differs very considerably in construction from the air-cooled Type ME lamp. The arc tube consists of a small bore, thick-walled quartz tube, having at each end a bare tungsten electrode which may be sealed into it by means of a bead of special sealing glass, which will seal satisfactorily to both tungsten and

OFFICERS AND BRANCH MANAGERS OF NATIONAL THEATRE SUPPLY CO. AT RECENT N. Y. MEETING

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quartz. Each end of the arc tube is shaped so that a chamber is formed in which a pool of mercury is retained. The electrodes project slightly beyond the surface of these mercury pools.

In an experimental form one end of the lamp is fitted with a brass cap and the other end is supported in an ebonite mounting to insulate it from the water in which it is immersed. The high-tension lead is taken to a terminal in this insulated mounting. The lamp is mounted in a water jacket consisting of two concentric glass cylinders supported between metal rings, one of which is earthed, and to which the water connection and one electrical connection are made. A rapid flow of water is passed through the jacket in order to cool the arc tube.

Probably the most unusual feature of the water-cooled lamp is the very short run-up time, as full light output is available within three seconds after switching on. Also, the arc will re-strike immediately the supply is restored in the event of a failure of the supply. These delay times are so short owing to the small heat content of the lamp. This is a very great advantage over the other forms of high-pressure mercury vapor lamps.

The life of the water-cooled lamp depends on the operating cycle, as frequent starting tends to shorten the life. The inside of the arc tube operates at a very high temperature and much attention has to be paid to the avoidance of devitrification of the quartz during operation.

Although the internal pressure may exceed 100 atmospheres, even if a lamp should burst no damage results in this case, as the energy in the explosion is not great due to the small volume of the arc tube. The water jacket is sufficiently strong so that it will not be broken in the event of the inner lamp bursting. At the end of its life the lamp may be withdrawn and a new lamp inserted.

Characteristics of Emission

Perhaps the most useful feature of the water-cooled lamp is the very small amount of heat radiation. Spectral distribution comparison shows that a far greater proportion of the input is radiated in the infra-red region in a tungsten filament lamp than in the case of the Type MD/H lamp. Out of the total radiation of 700 watts in the infra-red region from the Type MD/H lamp, 630 watts is carried away by the cooling water and the remaining 70 watts is radiated.

Compared with a tungsten filament lamp of equal wattage which radiates nearly 700 watts of infra-red energy, the water-cooled lamp gives more than twice the light and less than half the total wattage radiated. This fact is strikingly borne out by available data on the relative increase in temperature of the skin exposed to light from tungsten and the Type MD/H lamp. For equal increases in temperature, 4½ times the illumination may be used in the case of the water-cooled lamp.

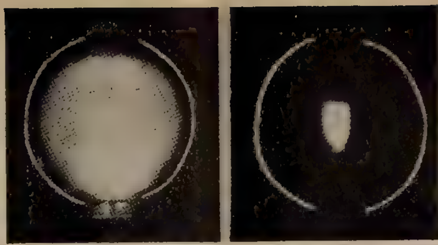


FIGURE 2

Compact source lamp; left, just after starting; right, in fully run-up condition

Operation of Type MD/H Lamp

The Type MD/H lamp operates from an A.C. supply through a high-reactance transformer of special design, or from a high-voltage D.C. generator with a resistance ballast. The cooling water may be taken from the water supply mains, unless this supply is very "hard," although it may be preferable to operate the lamp from a self-contained pump which circulates distilled water through a fan-cooled radiator. The temperature rise in the cooling water is only a few degrees Centigrade.

In order to safeguard against failure of the water supply with consequent damage to the lamp, a pressure switch is used to prevent the supply to the lamp from being applied, unless there is the required quantity of water flowing through the jacket. The water flow is about three quarts per minute for a 1,000-watt lamp.

The water-cooled lamp at a loading of 840 watts per cm. compares very favorably with the carbon arc as regards color, except for the increase at the blue end of the spectrum, which may be readily corrected with a filter. This loading is too high to give lamps of long life, but practical tests have shown that a lamp with a loading of 800 watts per cm. and having a voltage gradient of 420 volts per cm. gives reasonably good color rendering when used in a motion picture projector.

The Type MD/H water-cooled lamp of medium brightness is made in 500-, 1000-, and 2000-watt sizes, all of which operate at the same loading of 400 watts per cm. and have the same average brightness of 24,000 c.p.s.c.

A 1000-watt lamp with a loading of 800 watts per cm., which has a shorter arc length and a higher average brightness of 48,000 c.p.s.c., has been made. The high brightness of this lamp makes it a possible source for motion picture projection. The mercury vapor pressure there in is very high, and, as mentioned previously, this lamp gives a reasonably good rendering when used for the projection of colored films. Owing to the higher loading, the life will necessarily be shorter than that of the normal 1000-watt lamp, but it has nevertheless a useful value.

In order to make a water-cooled lamp of higher wattage, without increasing the wattage per cm. of the arc tube, and thus reducing the life, it is necessary to increase the arc length proportionately to the wattage. The operating voltage must also be increased in the same proportion to keep the voltage gradient constant. Thus a high wattage lamp requires a very high operating voltage and has a long light source.

The chief characteristics of Type MD/H lamps are as follows:

(1) Small amount of heat output.

(2) High brightness and a very efficient light source.

(3) The light source is linear in shape.

(4) The delay times for obtaining full light output and for re-striking are very short indeed.

(5) The radiation has a high actinic value.

(6) The light output may be readily controlled.

These characteristics render the lamp suitable for a number of applications. Among these may be mentioned film studio lighting where a very high level of illumination is required and the reduction of the heat from the lamps has always been a problem. Similar considerations apply in lighting television studios; in this case it is also claimed that the spectral distribution of the water-cooled mercury vapor lamp is very siutable for using in conjunction with the Iconoscope.

In conclusion, it is clear that both the air-cooled and water-cooled high-pressure mercury vapor lamps should find useful applications, particularly in the kinema industry. While both lamps have certain disadvantages, these are outweighed in many cases by other characteristics.

(See Editorial on Page 23)

SLOT MACHINE MOVIES TO BE LICENSED IN N. Y. CITY

A campaign to license all coin-in-the-slot motion picture machines in New York City is being launched by Paul Moss, license commissioner. Every such device, Commissioner Moss said, will be required to be licensed under the law, adding that any violation "will be dealt with."

Manufacturers and distributors were advised to arrange with the License Department to formulate plans to carry on their business under the provisions of the administrative code of the city which defines a motion picture as being "a display on a screen or other device of pictures or objects in motion or rapidly changing scenery whether or not such display shall be accompanied by lecture, recitation or music."

Merit Rating in Unemployment Compensation

By *ROY M. BREWER*

SECRETARY, I. A. 9th DISTRICT

HERE in Nebraska, we have had a problem with relation to Unemployment Compensation. This information will only be valuable to those states which have an Unemployment Compensation Law containing what is known as merit rating provisions. This is a provision whereby an employer who accumulates a certain reserve to his credit is given a reduced tax rate.

Because Nebraska has a liberal law with respect to merit rating, this problem has arisen here earlier than in most of the other states, but many of the states have laws containing merit rating provisions which will go ino effect in the near future.

There are two ways in which our locals are affected:

(1) If one of our members or a member of a sister local working in that jurisdiction is taken off the job by the local union, this member is entitled to file for Unemployment Compensation, to which he is entitled under the law. However, in Nebraska, we have found that where our employers are trying to build up their reserves to enable them to get a reduced tax, they are complaining bitterly to the local unions about having to pay additional tax because of the action of the local union.

From all legal standpoints, these members are entitled to Unemployment Compensation, but it is indicated that a concerted drive will be made by employers to interfere with our method of assigning men to work if we don't meet the situation.

Temporary Work Problem

(2) Another problem which should be watched is the assigning of men to work temporarily. Under most state laws, an employer is required to report the earnings of every individual employee, and when an employee files a claim for compensation, his earnings are totalled and it is necessary that he have a total of a given amount to make him eligible for Unemployment Compensation. Also, the total amount of benefits which he can draw is in direct relation to the total amount of employment he has earned in his base period, usually from one-third to one-sixth of that amount.

If our men are assigned to jobs temporarily and no change is made in the payroll, an employee, in filing a claim, could embarrass the employer and, indirectly, our organizations, for giving him employment without having him on the payroll and having his employment reported to the Unemployment Compensation Commission.

As stated previously, because Nebraska has a liberal law with respect to merit rating, this problem has shown up in our state first; it will surely show up in many of the other states either this year or next year when merit rating credit begins to become operative. Any additional information relative to experiences in other states with this law will be welcome; and, in turn, the writer will be glad to assist any interested party.

Technicolor Footage Rise As Lab Advances Continue

Despite the voluntary reduction of 1 cent per foot, made effective the latter half of 1940, Technicolor, Inc., for the year ended December 31 last, shows an increase of more than 10,000,000 feet of positive prints shipped during the span, and a net profit for the period of $882,125.65, according to the annual report just issued to stockholders by Dr. Herbert T. Kalmus, president.

Technicolor manufactured and sold about 80,000,000 feet during 1940, with net sales amounting to $5,103,404.58.

Dr. Kalmus, anticipating trade questions as to when the industry will get Technicolor monopack prints, asserts that the present primary interest of the company in the monopack process is not for release prints, because the so-called triple layer raw film "appears inherently to be so expensive that it could hardly compete in cost with Technicolor imbibition prints."

Monopack Not for Release Prints

The present Technicolor process of photography employs three separate strips of negative, so it is frequently called Technicolor three-strip. Research department is active in improving this method of photography and in the laboratory procedure of manufacturing Technicolor imbibition release prints therefrom.

While current pictures by this method are enormously improved compared with those of a year or more ago, Technicolor engineers nevertheless expect great improvement in the present three-strip imbibition process both in quality and cost.

Company officials, however, do believe that monopack will be developed to be satisfactory for use as originals from which Technicolor imbibition prints can be made. Such an original, it is explained, can be exposed through any standard black-and-white motion picture camera and should thus have mechanical and cost advantages over three-strip negative.

Work on this procedure has been in progress for several years, has reached the point of decided encouragement for certain purposes, and is now being tried out on a semi-commercial experimental basis.

In the space of less than five months, these groups of men met sixty times (one panel met twelve times in that period), attended twenty test demonstrations at various laboratories, prepared nearly one hundred documents on assigned technical aspects of their panels' work, collected bibliographies and other miscellaneous information. This record is little short of monumental, judged by any standard. It is the work of engineers who have their hearts as well as their minds in the work. Their good will is manifest. It deserves the good will of the public and the government to which their recommendations will soon be made.

EASTMAN'S 20 MILLION EARNINGS

A consolidated net income for 1940 of $20,076,739, which includes only the net profits of the parent company and wholly-owned subsidiaries in the western hemisphere, was reported yesterday by Eastman Kodak. This figure is equivalent to $7.96 per share on the common stock.

Net earnings for 1939 totaled $21,537,577, or $8.55 per share on the common stock, but foreign subsidiaries contributed to some extent to this figure with the exception of the company's German companies.

A wage dividend of $2,396,054 payable to employees on March 24, 1941, has been authorized by the directors.

S.M.P.E. Convention in Rochester, May 5-8

THE Spring 1941 Convention of the Society of Motion Picture Engineers is scheduled for May 5-8, inclusive, in Rochester, N. Y. This home city of so many important manufacturers of motion picture equipment provides an ideal spot for this get-together and promises to at least equal, if not surpass, the notable success of the last engineers' gathering there.

Convention headquarters will be at the Sagamore Hotel, with registration and information quarters on the hotel roof, adjacent to the Glass House wherein all technical sessions will be held. Bill Kunzmann, convention vice-president, asks that all members and guests attending the meeting register and so help to defray the expenses of the convention.

Hotel reservation cards providing for moderate rates have already been mailed to Society members; non-members who plan to attend the convention should address the Sagamore Hotel direct. Ample facilities, including car storage, are available.

A Ladies Committee will again be on hand to look after the comfort and pleasure of all women in attendance. Golfing privileges at several Rochester clubs may be arranged through the S.M.P.E. registration desk. Four Rochester theatres will extend free admission privileges to convention registrants. Group visits to places of interest may also be arranged.

Details of the technical sessions have not yet been completed, but one of the most interesting presentations will be the demonstration of stereophonic sound reproduction to be staged by Bell Telephone Laboratories in the auditorium of the Eastman Theatre.

What's Happened to Television?

THOSE familiar with technical standardization are well aware of the fundamental conflict between the necessity for standards in order to initiate an art and the inhibiting effect which standards have on the future progress of that art. Essentially that is the conflict which "happened" to television. In itself, however, that conflict was not solely to blame. There were also a generous admixture of ordinary misunderstanding of what items in television really require standardization, as well as a few philosophical footnotes introduced by the prevailing thinking of governmental regulatory bodies.

One of these philosophies is the principle enunciated by the Federal Communications Commission, that equipment or apparatus sold to the public should retain its "original degree of usefulness" indefinitely. Thus the crystal sets of twenty years ago are just as good today as they ever were; in fact, they perform better, because broadcast stations have improved in the meantime. According to the principle, the F.C.C. would not knowingly permit standard broadcast stations to change their method of transmission in any way which would lower the utility of the crystal set or any other kind of set sold to the public in good faith.

[Parenthetically it should be noted that crystal sets and other standard receivers are not suitable for reception of frequency-modulated, staticless broadcasting scheduled for commercial operation this year, but presumably the standard broadcast stations will remain in operation to serve these receivers until the public has no further use for them.]

The Obsolescence Factor

The application of the obsolescence-not-permitted principle to television sets is dictated by the fact that a variety of changes in methods of television transmission is conceivable. If adopted, these changes would render existing receivers completely useless. Note that these changes are *conceivable.* Whether they might become *desirable* changes is a moot question, one which the National Television System Committee has been called upon to answer.

The method of sending television pictures, it will be recalled, involves the analysis of the image in the television camera into a series of horizontal lines and the transmission of the information contained in these lines, one after the

Television standards formulated by the National Television System Committee, composed of 169 members prominent in the development of this baby art, are now under consideration by the Federal Communications Commission. Acceptance of these standards by the F.C.C., which now appears distinctly probably, will clear the way for rapid and large-scale development of television. Coincidently, the N. T. S. Committee has made available the accompanying article, a contribution by Donald G. Fink to the "Technology Review" for January, 1941.

Mr. Fink's article so very ably provides the answer to the question posed by its title that it becomes required reading for all those interested in the development of television.

other, until the whole picture has been covered. The process is repeated rapidly enough so that many pictures may be sent each second.

The number of lines required depends on the degree of pictorial detail desired vertically in the reproduction; whereas the number of pictures to be sent each second is determined by the tendency of the pictures to flicker and by the necessity for reproducing motion smoothly. When these specifications have been decided, the detail along each horizontal line is governed by the space in the ether assigned the transmission system.

According to the original standards of the Radio Manufacturers Association, a picture is divided into 441 lines (about 410 of which are active in the reproduced picture); pictures are sent at a rate of thirty a second; and the width of the communication channel assigned to the transmission is about 4.0 to 4.5 megacycles a second (approximately 450 times the space required by a broadcasting station).

Working at its best, a system of this kind is capable of reproducing a picture having a quality roughly equivalent to that of a good 16 mm. home movie, with total visible detail a quarter that to be found in the professional 35 mm. motion picture.

Whether a television picture like this is capable of supporting an entertainment service is of course a very important question. The prevailing opinion seems to be that the system is perfectly capable of supporting a service carefully planned with the limitations in mind, fut that eventually a more detailed image will be demanded. The word "eventually" is important because at present television technique has not progressed to the point where an image of substantially greater detail than this can be produced in a commercially practical system.

The question is whether we should go ahead with the present realizable system or whether we should delay commercial operation until the engineers find the way to provide the better image. Were it simply a matter of waiting for a short period of time until techniques now in the laboratory should be reduced to commercial practice, there could hardly be any argument about the more desirable procedure. But the situation is not so simple. The technical answer is not in sight. Moreover, other matters have to be considered.

One of the crucial points is the number of stations which can be accommodated in the spectrum, a question which in turn bears on the degree to which the assignees of television station licenses shall monopolize the ether.

Ether Space Limitations

The F.C.C., on the recommendation of the R.M.A. several years ago, established the total amount of ether space to be allocated to each station at six megacycles a second, sufficient for the 4.5-megacycle channel previously mentioned and for other technically necessary space, including that for the accompanying sound broadcasts. This amount allows about seven useful television channels at present.

Now, it is a fact that if the number of details in the picture is to be doubled, for example, the amount of ether space per station must be doubled, and the number of available station assignments thereby halved. Here, then, is a decision of quality versus quantity. Shall there be, eventually, a better television image but a reduced choice of programs? This is the sort of judicial nicety for which a governmental agency's judgment is required, because it is not a matter of engineering; it is a matter of the public interest, convenience, and necessity.

The F.C.C., in the present deliberations, has let it be known that the six-megacycle allocation is its choice and that this figure may be used as the basis

for the deliberations of the N.T.S. Committee.

At the same time, the commission points to the possibility of twelve-megacycle assignments in a region of the spectrum not yet available, implying that future developments may be taken care of on these as yet unuseful channels.

Here the ugly spectre of obsolesence reappears, since receivers designed for the six-megacycle channels cannot do justice to the twelve-megacycle broadcasts, nor is it likely that the former could be used at all, especially since the number of lines per picture would be increased, roughly, from 450 to 700. While receivers could be built to cover both values, the expense of so doing would hardly be justified.

The implication is that if the original degree of usefulness of the six-megacycle receivers is to be retained indefinitely, the broadcasters must operate two sets of stations, one for the old receivers, another for the new. This possibility, however, is far in the future, far enough for the F.C.C. to be content to have standards drawn up solely on the basis of the six-megacycle channel.

Image Detail Considerations

Once this major aspect of ether space is decided, the subsidiary questions can be attacked. First of all comes the question of the relative degree of detail in the vertical and horizontal dimensions. Offhand, it appears that these two degrees of detail should be the same, but tests have shown that a considerable amount of disparity may exist before the eye can detect it.

The number of lines in a picture is hence not the bugbear it was once considered to be. For ordinary subject matter almost any value from 400 to 600 lines a picture can be chosen without affecting the picture visibly, as long as the communication channel width is fixed.

Next comes the question of how many separate pictures, or frames, should be sent a second. If the number of pictures is reduced, the detail in them may be proportionately increased, with a given communication channel. Hence the suggestion has been made that only 15 frames be sent each second, rather than the previously established 30 frames, thus allowing a doubling of the total pictorial detail without a widening of the communication channel.

The slower rate of reproduction tends to introduce flicker in the result and to limit the speed with which objects in the picture can move without appearing to proceed in jumps. This matter can be decided only by performance tests, many of which are now being carried out.

Color Television Status

A third question which arose soon after the N.T.S. Committee got under way was that of color television. Experiments with color television are not new; most of them produced such poor results or cost so much to operate that none was considered until Peter C. Goldmark, of C.B.S., demonstrated colored transmissions late last Summer.

These color reproductions were excellent, and the system could be accommodated on the six-megacycle channel. The pictorial detail was lessened somewhat to allow introduction of the color aspect, and the receiver demonstrated had a rotating disk containing colored filter segments, which would presumably increase the cost of the receiver.

But the system seemed reasonably satisfactory in nearly all respects except one. At the time of the demonstration, no satisfactory method of thus televising subjects directly in the flesh had been developed. The demonstration was reproduced from colored slides and motion-picture film.

A partially satisfactory method of televising in color directly has since been reported but not demonstrated. Whether or not provision should be made for the introduction of color transmissions as soon as the method is perfected, is another question put up to the N.T.S. Committee.

The organization of the N.T.S. Committee follows the proved plan of delegating the fact finding and the preliminary decisions to small groups. In the N.T.S. Committee are nine such subcommittees, or panels, each having a specific function.

The main committee, to which the panels report, is composed of eighteen members and twelve alternates under the chairmanship of Walter R. G. Baker of General Electric Co., director of engineering for the R.M.A. To Dr. Baker was assigned the task of organizing and completing the basic personnel of the committee. The N.T.S. Committee, it should be remarked, is not a part of the R.M.A. but an independent body sponsored by the association with the active support of the F.C.C.

Television projection equipment installed in New Yorker Theatre to project 15 by 20-foot pictures on screen 60 feet away. Steel-jacketed projector is in foreground; to right are control desks for pictures and sound.

NEW G. E. MERCURY LIGHTS

A new television floodlight, which produces illumination of daylight intensity without extreme heat, has been developed by General Electric. Main feature of the floodlight is its ability to produce the general illumination needed for indoor television broadcasts without the almost unbearable heat created by the large number of incandescent lamps previously required.

At equal room temperatures, maintained by air conditioning, the sensible heat from the three 1000-watt mercury lamps of the unit is only about one-fourth that from general-service incandescent lamps giving comparable illumination. Over 50% of the heat generated by the mercury lamps is carried away by water passing through the lamps at the rate of one gallon a minute.

Although each of the three mercury lamps is smaller than a cigarette, mounted together in front of the high-efficiency parabolic reflector of the floodlight, they produce 195,000 lumens of light. This is the equivalent of 750 foot-candles over an area of approximately 100 square feet, or the lighting intensity out-of-doors on a reasonably fair day.

DETROIT SLOT MACHINE BATTLE

First slot movie machine in Detroit played to 1000 nickels over three days of operation in a local night club. Two more installations are planned soon by Phonovision Co. A local ordinance establishing city control over the machines is pending. Projection group is seeking to have machines licensed as "theatrical exhibits" subject to same police control as theatres, rather than as coin or music machines.

PENNA. 2-MEN SHIFT BILL

A bill has been introduced in the Pennsylvania Legislature which would require employment of a projectionist for each machine operated in any projection room in the state.

ALEXANDER 25 YEARS WED

A. W. Alexander, Altec service engineer of Asheville, N. C., has just celebrated his silver wedding anniversary.

The EDITORIAL PAGE

Vol. 16, No. 2 FEBRUARY 1941

Mercury-Vapor Not Ready for Projection Yet

This is a statement about scientists and Britishers. An odd pairing? Not at all, when one considers the strange outgivings of such a combination. Men of science are traditionally conservative and overly cautious about advancing claims for any product or process that are not supported by cold, hard fact. Britishers are a phlegmatic lot, and their enthusiasms seldom pass the stage of a tight, grim smile. All of which makes it extremely difficult to understand the persistent campaign being waged by British technologists to advance the cause of the high-pressure, mercury-vapor arc lamp as a satisfactory source of light for the projection ot motion pictures. A case in point is the latest effusion of British scientists on this topic, excerpts from which appear elsewhere in this issue.

For several years past the British film journals have been beating the tom-toms in behalf of the mercury-vapor lamp. These articles, while extremely interesting and worthy of attention by all movie technical workers, present the extraordinary spectacle of a head and a tail that just don't belong to the same horse. In other words, neither the body nor the summary of any article on this subject tends to support the promise of either the heading or the premise. Maybe we're backwoods folk and just cain't read aright, but these European articles leave us as cold as the light source they discuss.

These articles invariably open up with the unqualified assertion that "recent progress" has now rendered the mercury-vapor lamp a "wholly acceptable" light source for the projection of motion pictures. Thoroughly aroused, we avidly dig into the article and jump from one paragraph to another with great expectancy. What a letdown! In the body of the article we come across several statements—admissions would be the better word—anent mercury-vapor lamp characteristics which induce vague doubts as to the fulfillment of the premise. By the time we reach the summary our interest and enthusiasm have waned, and we steel ourselves for the denouement. The summary blandly informs us that the mercury-vapor lamp is just swell for "general lighting" such as film and television studios, photo-engraving work, slide-film projection and a few other run-of-the-mill applications. Practically nothing has been adduced that would warrant the belief that this light source in its present stage of development is suitable for use in the professional projection field.

Now, it is not our intent to discredit the mercury-vapor lamp as a possible important projection adjunct in the future. It is a development that merits the close attention of every film worker who is interested in technological progress. It is not impossible that some radical improvement will be effected in this light source that will, overnight, make it acceptable for projection purposes, just as has happened with so many other "it-can't-be-dones." Most important of these "musts" is a decided improvement in spectral characteristics and a more efficient system of cooling, the latter now being accomplished by a flow of water at the rate of approximately three quarts per minute.

Any suggestion that the mercury-vapor lamp at present even remotely approaches the overall efficiency of the carbon arc as a light source for the projection of motion pictures must be shunted aside in view of the definite shortcomings of the former as detailed by its own most vociferous supporters. The carbon arc is in there pitching day after day in thousands of theatres throughout the world, and it is today the only suitable light source for theatre projection. Moreover, the carbon people have not been resting on their oars. Their accomplishments during the past few years in the direction of more efficient and less expensive carbon trims make ever so much more difficult the task essayed by proponents of the mercury-vapor arc. The latter will harm rather than help their cause by the dissemination of propaganda which has no basis in fact.

The Exhibitors' Contribution to Technology

The writer had occasion recently to refresh his memory on the score of the peculiar mental traits of film exhibitors. The setting was a legislative hearing on a two-men projection shift bill. Naturally, we heard the old familiar chant of poor business, rising costs (with labor and taxes emphasized the while 50- and 60-percent film rental deals were ignored), along with heart-rending stories of how bankruptcy was imminent. (P.S.: Two days later five of these "starving" exhibitors were spotted in a New York night club preparatory to shoving off on the morrow for their annual mid-winter vacation in Florida.)

All this is old stuff, of course, and was fully anticipated. This time, however, the exhibitors introduced a new and sinister note into the proceedings. After the writer had his say, in which he described the projection process and adduced a few facts anent carbon arcs, sound systems, etc., the exhibitors demanded to know the sources of these data. Promptly forthcoming were these sources, which, incidentally, were handbooks and other publications by reputable, impartial engineering laboratories.

The response was immediate, if a bit disconcerting. In the first place, the writer was nothing but a "New York racketeer" who was known throughout the country as a "paid propagandizer and agent for the A. F. of L." Moreover, they didn't require any "wise guy from New York" to come into their State, where all is light and joy, and "tell them how to run their business." As for the technical data submitted, it might be a good thing if these "vicious monopolies" were broken up by means of more effective competition. (This, mind you, from those who yell "murder" if a new house opens within twenty blocks of their own.)

The personal abuse we minded not at all, having been inured to this type of blast through the years. But the utter disregard shown by these people for the technical processes which alone enable them to operate and which constitute their chief stock in trade demands some serious reflection by all those agencies which are working hard to raise the technical standards of this industry. Where does this leave the S.M.P.E., the Academy, the studio technical workers, the manufacturers and, last but not least, the great army of projectionists through whose efforts technology has progressed in this industry? It can be stated flatly that exhibitors, as a group, have contributed precisely zero to the advances which have made possible the high artistic and technical standards of motion pictures today—the very means by which these exhibitors survive.

Some Recent Developments in 8mm. 'Suprex' Copper-Coated, H.-I. Carbons†

By *W. W. LOZIER, G. E. CRANCH,* and *D. B. JOY*
ENGINEERING DEPARTMENT, NATIONAL CARBON COMPANY

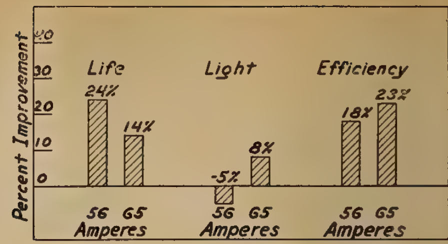


FIGURE 2

Per cent improvement in operating characteristics of experimental 8-mm copper-coated high-intensity positive carbons over 8-mm National "Suprex"

SINCE the introduction of the "Suprex" carbons about seven or eight years ago there has been a remarkable expansion in the use of these small-diameter, copper-coated carbons. The rapid growth of this type of arc is evidenced by its use in the majority of all the medium-sized theatres in the country. The wide acceptance of this high-intensity arc using a copper-coated, non-rotating positive carbon and reflector type lamp is largely due to the resultant brilliant snow-white light on the projection screen and to the economy of operation.

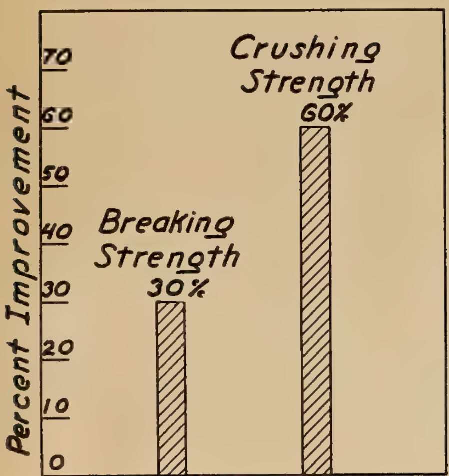


FIGURE 1

Improvement in strength of carbon shells; experimental 8-mm shell over present 8-mm shell

Recently there have been introduced lamps and carbons which have extended the use of the high-intensity arc to the smallest theatres in the form of the "One-Kilowatt Arcs."

Development work has continued in our laboratories on these non-rotating, high-intensity carbons. This paper reports the progress on a new 8-mm. copper-coated carbon of this type which, however, is not yet ready for distribution. This new carbon is stronger, produces light more efficiently, burns more steadily, and can be operated at higher currents than the present 8-mm. "Suprex" positive.

Characteristics of New Carbon

Strength of the Carbon.—Carbon shells under stress deform only a small amount before they fracture, and therefore do not give the warning of the proximity of fracture that would be conveyed by a more deformable material of the same ultimate strength. This should be kept in mind in clamping the carbons in the carbon holders, which in most "Suprex" type lamps exert a powerful leverage capable of cracking the carbons if excess pressure is used. This is particularly true in the case of the positive carbon holder.

The result of this cracking, which may be either transverse or longitudinal, is concealed by the copper coating but becomes evident when the carbon has been advanced in the holder and consumed to the point where the fracture exists. It is therefore of extreme importance that care be taken in clamping carbons in holders firmly but not excessively, and also in avoiding dropping carbons on the floor or otherwise mistreating them.

This new experimental carbon has a shell with both a higher transverse breaking strength and a higher crushing strength than the present one, as indicated in Fig. 1. Transverse breaking strength has been increased by 30%, and the crushing strength, which is intimately connected with the action of the holder on the carbon, has been increased by 60%.

Therefore this increase in shell strength gives more assurance that these carbons will be free from breaks and cracks during the burning period. However, it does not mean that they are unbreakable, but that they have a substantially increased factor of safety with respect to breakage.

Burning Performance. — This experimental carbon has 24% longer life at 56 amperes, the lower limit of its current range, and 14% longer life at 65 amperes, which is the maximum current for which the present 8-mm. "Suprex" carbon is rated. Moreover this is accomplished with only a 5% reduction in screen light at 56 amperes and an actual increase of 8% in screen light at 65 amperes.

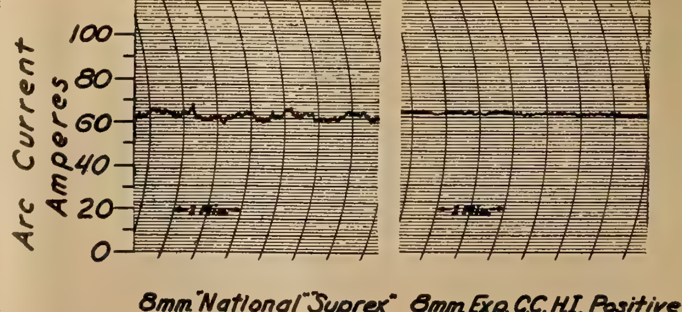
If the amount of screen light is multiplied by the burning life, a measure of the efficiency of utilization of the carbon is obtained. For example, the product of the screen light in lumens and the burning life in hours per inch gives the total light energy in lumen-hours per inch of positive carbon.

Fig. 2 shows that this experimental carbon gives materially more light energy per inch of positive carbon consumed, ranging from an 18% increase at 56 amperes to a 23% increase at 65 amperes. At 59 amperes the consumption of the experimental carbon is the same as that of the present 8-mm. "Suprex" at 56 amperes, but the new carbon under these conditions gives 10% more light. Similarly, at 63 amperes the new carbon matches the consumption of the present "Suprex" at 60 amperes but gives 10% more light. These figures show that the user will be getting substantially more light energy per carbon.

Arcs operated with the low-voltage power sources commonly used with "Suprex" type lamps often show noticeable current fluctuation. This is the result of a compensating action between the arc and the power source such that the current responds to momentary voltage changes in a manner tending to maintain a steady light output.

The experimental carbon, particularly at the higher currents, gives a more stable arc and thereby eliminates to a large extent the necessity of compensating current fluctuations. Fig. 3 shows the superior stability at 65 amperes of the

FIGURE 3
Records of the arc current showing the improved stability of the experimental 8-mm carbon over the 8-mm National "Suprex" positive



† J. Soc. Mot. Pict. Eng. (Feb., 1941).

new carbon compared to the present 8-mm. "Suprex."

In some theatres now using "Suprex" carbons it would be desirable to obtain more light than can be obtained with the present 8-mm. positive carbon at 65 amperes. Higher currents have not been feasible because it has been found that the present 8-mm. "Suprex" positive cannot be operated much above its maximum current rating of 65 amperes without excessive current fluctuation. The experimental 8-mm. positive carbon does not show this undesirable feature even at 70 amperes and opens up the possibility of obtaining further increases in light.

At 68 amperes the new carbon has the same consumption rate as the present "Suprex" at 65 amperes but gives about 20% more light. At 70 amperes the new carbon delivers about 25% more light with about 10% higher consumption rate than the present "Suprex" at 65 amperes. When the current is increased from 65 to 70 amperes at the same arc length, the arc voltage increases about 2 volts.

This increase in arc current and voltage might exceed the capacity of some of the power sources while the increased consumption is too great for most of the feed motors. However, the increase in voltage can be avoided by shortening the arc length about 0.05 inch, which will also reduce the consumption at 70 amperes so that some of the lamps can feed the carbons rapidly enough.

With these higher consumption rates, it is important that the negative be carried at its correct position because the crater face can become malformed very quickly if a poorly aligned negative is not corrected promptly.

When low-voltage power sources designed for "Suprex" type lamps and carbons are used, the new carbon can be burned from 56 to 70 amperes subject at 70 amperes to the limitations just described. In a few theatres there are still some old, high-voltage generators originally designed for *Hi-Lo* lamps. With these power sources, best results will be obtained with the new carbon if the current is maintained at or above 60 amperes.

This experimental 8-mm. copper-coated high-intensity positive carbon has the best features of the present "Suprex" carbon, and, in addition, has the advantages of greater strength, higher efficiency, steadier operation, and a wider current range, and therefore represents a significant advance over the present carbon.

IOWA TAXES SLOT-MACHINE FILM

The Iowa House has passed a bill licensing new slot-machine movies at $100 a year after explanation that only eight were operating in Iowa. Bill's sponsors claimed one machine took in $146 in its first week in operation in Des Moines, while others maintained the machines were "a bust" and promoters were "losing their shirts." One representative asserted promoters merely were waiting until the legislature adjourned before flooding the State with machines.

STRINGENT IOWA BILL AIMED AT PROJECTION ROOMS

Bill introduced in the Iowa State Senate relative to construction of new theatres has minimum requirements for projection rooms of 48 square feet area for one projector, and an added 24 square feet for each additional machine. "Wherever feasible" there must be two door exits from each projection room, and each room must have a water closet or toilet stool installed either in the room proper or closely adjoining.

Ladders as a means of entrance and egress from projection rooms are forbidden. Stiff penalties are provided for violation of the rules, with jail sentences set at not exceeding 60 days or fines of not more than $500, or both.

KEEPING DUST OFF LENSES

A simple and inexpensive way to prevent dust from collecting on the lens front while you are away from the projection room: purchase a few oil silk jelly glass or refrigerator bowl covers from the 5 & 10. The covers have an elastic band and will snap neatly and tightly over the lens barrels.

'Dollar Publicity' Backfires on Movie Industry

INDICATIVE of the sort of publicity the movies get when annual executive and star salaries are announced is the following "lift" from H. I. Phillips' column in the *New York Sun*, penned by his own creation, one Elmer Twitchell:

". . . I am writing to ask if it is all a gag or if they really get that kind of dough. I see Louis B. Mayer topped the list with a salary of $688,396 a year and just when I am recovering my breath I am knocked over again by the statement that this is a 40 per cent cut from his previous salary. Compared to what he gets in a good year, he is practically on relief.

"Well, I don't know Mr. Mayer, but I didn't see no movies that would indicate the head man rated so much money, and the same goes for the Hollywood stars. Claudette Colbert was up near the top with $426,944 for one year which is around 8,000 pazootas a week. I didn't see Claudette's pictures, but I must begin following them at once because I want to find out what she does to gear pay checks like that. Bing Crosby was next with $410,000. I saw most of Bing's pictures and I hope Hollywood has a conscience fund so he can give something back.

"Irene Dunne got $405,222. I always liked Irene, but that salary has ruined her for me. What I mean is I could never see her again in one of those pictures where she is a poor struggling young woman giving life a stiff battle without knowing it's the bunk.

"Clark Gable got $272,000. This surprised me as it must be the kind of salary they start you in on in Hollywood and I think Clark should get a raise. The second highest American salary went to a Mr. Countway, who is not a movie man at all but a soap manufacturer and I think if a soap man gets $469,713 Gable should get something close to it. What I mean is I will never enjoy washing again without thinking that maybe the man who made the cake of soap gets more dough than Gable who had to stand all those terrible years with Scarlett O'Hara.

"If I was to pick out a business where the big money was I would never have picked the soap business, but on the other hand I suppose it takes more work to put over soap in this country than it does movies. Lots of people can get along without soap, but movies are a necessity."

SOUND OPTICAL SYSTEM DATA

One of the most common sources of trouble with optical systems is excess oil. While the optical units are carefully sealed at the time of manufacture, it is almost impossible to keep the seals intact indefinitely. The optical unit is exposed to a continuous heat cycle due to the fact that it is located so close to the exciter lamp.

As the unit heats up, different parts, such as the glass lenses and their retaining rings, expand to different degrees. This strains the sealing cement which eventually allows minute air leaks to form. From then on, whenever the optical unit heats up, the air inside expands and escapes through these air leaks. When the exciter lamp is turned off, the air inside the unit contracts, creating a partial vacuum which draws air in from outside. If this air is laden with oil vapor, the oil is drawn into the unit and finally condenses inside.

Excess Oil Removal Vital

This continual "breathing" of the optical unit eventually causes enough oil to collect inside to seriously impair the quality of sound reproduction. This trouble can be largely overcome if the soundhead and projector are kept clean and free of excess oil at all times. The air in the vicinity of the optical system will then contain no oil vapor and hence the "breathing" action will not be harmful, if it takes place.

Since the sound quality is affected by the sharpness and the intensity of the scanning beam, the optical lenses should be kept wiped clean at all times, but the complete unit should not be removed nor the adjustments disturbed. Only standard lens tissue or a very soft lintless cloth should be used for cleaning the lens surfaces to avoid possible scratching. With moderate care and cleanliness, an optical system will give an almost indefinite period of trouble-free service.

B. & K. SET FOR TELEVISION

Balaban & Katz, Paramount's Chicago-affiliated theatre circuit, has notified the Federal Communications Commission that it is ready to proceed with television programs "regardless of cost". Supporting the stand of Du Mont, in which Par is heavily interested financially, B. & K. asked only that the F. C. C. fix standards so that any set can receive any radio or television broadcast.

C.I.O. Mid-Western Unit Bids for Technician Support

EVIDENCE of the continuing keen interest of the C.I.O. in the motion picture projection field is contained in the appended copy of a letter sent out by the Minnesota State Industrial Union Council, affiliated with the C.I.O. I. P.

is able to reprint this letter through the courtesy of Roy M. Brewer, Secretary of the Ninth District, I.A.T.S.E., who forwarded the data. The letter follows:

MINNESOTA STATE INDUSTRIAL UNION COUNCIL
Affiliated with the C.I.O.
1126 Harmon Place, Minneapolis, Minn.

Look at the latest threat to our jobs, our businesses — yes, to our livelihood. "Box Office" magazine recently reported:

"Northwest Allied has started a campaign to have 16 mm. film banned from . . . non-theatre buildings. An effort will be made to get a prohibitory law passed by the next legislature. The narrow gauge films in other than theatres are declared to constitute increasingly serious opposition for the showhouses."

They weren't satisfied to have their regular theatre operators compete against us by working our jobs for practically nothing, so they're planning to legislate the entire lot of us out of existence. And their latest shot is aimed at every operator of 16 mm. portables in the Northwest, which includes you and your projector.

We're not going to take this lying down. We know you won't. That's why we're ORGANIZING. And we want you with us —NOW—by return mail, or come to Minneapolis and see us personally.

We have to act right away because state legislatures meet soon for their biennial sessions, and we have little time to prepare the fight against our banishment.

This is one of the important reasons for our joining the powerful CIO through the Minnesota State Industrial Union Council. It will enable us to get the help of the CIO in the various states, and nationally, as well as the influence of a number of other large organizations, all of whom are well experienced in legislative matters. One thing is certain: We won't feel lonesome in the company of 5,000,000 organized persons seeking a decent return for services rendered.

Why not the AFL? Frankly, they don't want us. The theatre operators are organized by them—AND THEY'RE THE ONES WHO HAVE BEEN TAKING OUR JOBS FOR LITTLE OR NOTHING TO PUT US OUT INTO THE COLD. Once in the CIO, we are confident we can stop this bad practice which is aimed to drive us out of business. (If you haven't been victimized by it yet, you're simply lucky.)

Organization? Dues? We'll have our own union in the CIO, democratically run. Initiation fee is only $2.00; dues are $1.00 per month. Fill in the application blank below, detach, and mail to us at this address, together with the $2.00 initiation fee. Come on, let's go. In any event, please let us hear from you.

MOTION PICTURE EXHIBITORS AND OPERATORS UNION, C.I.O.
1126 Harmon Place, Minneapolis, Minn.

FEDS. INVESTIGATE AFM-AGMA JURISDICTIONAL WAR

A Federal Grand Jury investigation into the jurisdictional dispute between James C. Petrillo, of Chicago, president of the American Federation of Musicians, and the American Guild of Musical Artists, headed by Lawrence Tibbett, has been announced by the Department of Justice.

The Government statement charged that Petrillo, whose power in the AFM, described as "absolute and subject to no control," had attempted to destroy AGMA and to "force the artists either to join his own union, the AFM, or to lose the benefits of union protection."

AFM Order Affects Many Groups

"Information in the department files," it continued, "shows that Petrillo has notified Tibbett that unless the members of AGMA resign from that organization and join AFM, he (Petrillo) will notify all radio interests, picture studios, symphony orchestra managements, grand opera companies, recording companies, booking agencies, etc., that members of AGMA will not be recognized by the AFM and that members of the AFM will not be permitted to render any services at any function at which AGMA members participate."

The IA-AFM mutual assistance pact still is in effect and might be invoked should the AFM make good its threat against the artists.

N. T. S. Projectionist Aid

Recognition of the increasingly important part projectionists will play in the selection of theatre equipment dur-

ing 1941 was one of the more important topics discussed during the recent annual sales meeting of National Theatre Supply Co. Looming large in National's 1941 promotional program will be the cooperation to be extended to projectionists, with special emphasis upon closer contacts and more informative bulletins relative to new equipment and the more effective use of old equipment.

National branch managers who attended the New York meeting were unanimous in asserting that the projectionist was vitally important in the matter of making theatre managers and owners equipment-conscious and in stimulating a desire for the best in projection accessories.

MOTIO'S NEW DRIVE-IN SOUND REPRODUCING SYSTEM

Motiograph, Inc., has developed a new sound system for Drive-In Theatres based on an entirely new method of sound reproduction as far as theatre use is concerned. The sound-on-film will be broadcast to the audience by radio transmitter and received by the audience in individual radio receivers located in each automobile.

The carrier current radio transmitter furnished in the system is similar to those used in telephoning to moving trains. It transmits on a single frequency far outside the ordinary radio broadcast range. The radio antenna consists of single conductor insulated wire arranged so as to uniformly distribute the radio frequency energy over the theatre area, thus providing high signal levels required for interference-free operation of receiver.

Receivers are contained in portable radio type cabinets which have no tuning dials and which will pick up only the signals from the theatre's own radio transmitter. The output of volume of receivers has been planned to be adequate to serve four or five people in each car comfortably and quality of sound output is believed to be superior to that obtainable from the average portable radio broadcast receiver.

The initial cost of the equipment is expected to be lower than the present Drive-In Theatre sound reproduction—either the systems embodying post-type speakers or the systems employing individual car speakers—as Motiograph's new system eliminates the necessity for installation of posts and individual wiring as well as replacement of equipment due to accident and adverse weather conditions.

VARIETY CLUBS CONVENTION

The National Variety Clubs Convention will be held in Atlantic City, N. J., May 15-17, inclusive. This organization numbers among its members many equipment manufacturers and projectionists.

W.E.'s 75-CENT DIVIDEND

Western Electric Co. declared a dividend of 75 cents per share on its common stock payable on March 31 to stock of record at the close of business on March 26.

AT YOUR SERVICE ITEMS

ONE of the hardest-to-get-to parts of most projector mechanisms can be made easily accessible for cleaning by slightly modifying the right (operating side) door. In the early days projectors had to be cranked, and it was desirable to be able to open the mechanism door without removing the crank; therefore, a notch was cut in the lower front section of the door so that the section that the crank passed through did not open.

Three screws are used to fasten this part to the main frame. Remove these screws, and take a net square piece of metal to patch this section to the door, so that the whole right side opens up as a door, making the mechanism more accessible for cleaning. On some mechanisms, the crankshaft extends through and beyond the cover, making this modification impossible unless you care to cut off the end of the shaft.—W. W. GILREATH, RCA, *Dallas, Texas.*

• • •

Projectionists and sound engineers frequently are presented with the problem of cleaning socket contacts and with the equipments using metal tubes, it is difficult to do a good job. The cleaning job is done very easy by the use of an ordinary pipe cleaner dipped in carbon tetrachloride: a few runs up and down through the contact will remove any corrosion that may have formed. On the older type of sockets using glass tubes with larger prongs, the pipe cleaner may be doubled up.—H. R. DAVIDSON, RCA, *Atlanta, Ga.*

• • •

Where uneven wear of holdback sprocket teeth is experienced, it is usually caused by misalignment of the lower magazine. If the back teeth of the sprocket wear faster than the front teeth, or *vice versa*, a shim placed between the soundhead and the magazine mounting bracket on the side on which the wear is at minimum will equalize the wear.—J. D. STEELY, RCA, *Pittsburgh.*

I. A. EXCHANGE LOCAL UNION REFERENDUM ON "A" RATING

General membership of the I. A. is now voting on a proposal to extend "A" rating to the exchange workers unions, which currently have a "B" rating. Higher classification would confer autonomy, including the right to negotiate for themselves, as well as convention representation. Tally is expected to be completed by the end of March.

SCREEN ACTORS AVERAGE $4,700 ANNUALLY, GUILD REPORTS

A survey showing that the annual income of actors and actresses numerically at the half-way point of their careers was $4,700 per year has been made public by the Screen Actors Guild. Survey was based on a canvass of the earnings of 300 "class A" members of the Guild for 1937-39.

Average income among the 300 players was $14,867, but the report explained that this figure was due to the higher salaries

in the upper brackets and it was pointed out that only 6.1% of the group earned more than $2,000 weekly.

Other percentage groups divide as follows in the report: Group 1—those earning $499 weekly or less, 42%; Group 2—those earning $500 to $999 weekly, 36.3%; Group 3—those earning $1,000 to $1,999 weekly, 14.9%.

MOVIE THEATRES ANNUAL TAKE

A U. S. Census Bureau report issued recently showed the annual intake of motion-picture theatres at $673,045,000. The unique nature of the picture production industry is indicated in the report. More than 93 million dollars was paid out in executive, supervisory, clerical and star salaries, representing nearly 50 percent of all production costs. Wages paid to skilled and unskilled manual labor amounted to less than half of the salaries paid to executives and creative talent.

Of the $215,664,929 total cost of production, pictures produced in California cost $186,848,971. The amount expended in New York State was $18,059,670.

RCA's 9 MILLION 1940 NET

RCA's net profit for 1940 jumped $1,030,345 over the preceding year to reach $9,113,156, the annual report of the corporation disclosed.

Total gross income from all sources amounted to $128,491,611 in 1940, compared with $110,494,398 in 1939, an increase of $17,997,213.

Operations for 1940 compared with 1939 show an increase in gross income of 16 per cent, an increase in net profit of 13 per cent, and an increase in the number of persons employed of 9 per cent. After payment of all preferred dividends, earnings applicable to the common stock were equivalent to 42.5 cents per share, compared with 35 cents per share for 1939.

FANCY M-G-M EXEC. PAY

Loew's Inc., paid $697,049 in salary and bonuses to Louis B. Mayer, Metro production head in the fiscal year ended Aug. 31, 1940, according to the corporation's annual report to the SEC. The report stated that $541,049 of this amount represented a share of the profits. The corporation paid $16,104,000 in salaries and bonuses to 228 executives in the last fiscal year.

Nicholas M. Schenck, president, received $318,881 and Hunt Stromberg, supervisor of production was paid $332,267 last year. Bonuses paid to executives include: J. Robert Rubin, $128,070; David Bernstein, $113,329; E. J. Mannix and Sam Katz, $96,356 each.

14,890 FILM PROJECTORS IN U. S. SCHOOLS—DEPT. OF COMMERCE

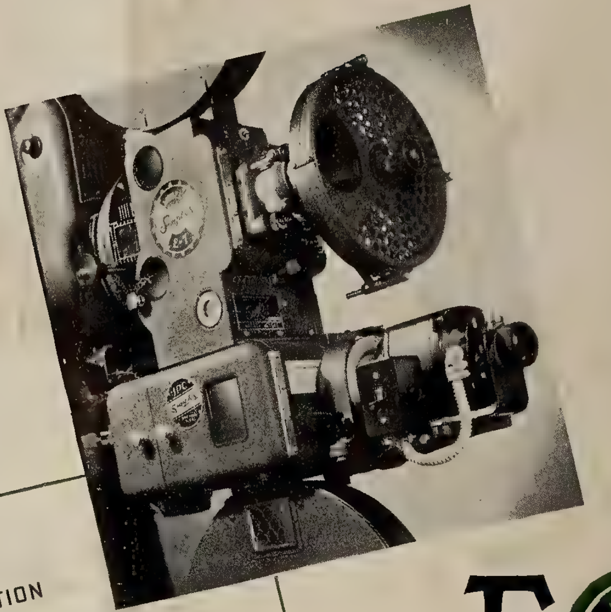
Increased use of motion pictures in the field of education as a result of the defense program was foreseen by Nathan D. Golden, chief, motion picture division, Department of Commerce, speaking before the department of visual instruction of the National Education Association.

Total movie projectors in colleges and schools was reported at 14,890. The present survey covers 12,443 16-mm. motion picture projectors and 2,447 35-mm. projectors which were reported as owned by colleges and high schools in the U. S. and its possessions. Of the 12,443 16-mm. projectors, 6,059 are silent and 6,384 are equipped for sound. Of the 2,447 35-mm. projectors, 1,624 are silent and 823 are sound.

The Projection Staff - LIBERTY THEATR
PORTLAND, OREGON *says* . . . .

100%
Simplex
REG. U.S. PAT. OFF.

GIVES
100%
SATISFACTION



EVERGREEN THEATRES CORPORATION
PORTLAND, OREGON

February 10, 1941

LIBERTY THEATRE

International Projector Corporation,
96 Gold Street,
New York City.

Gentlemen:

★ Twenty-six months ago this theatre was re-conditioned, and at that time a pair of Simplex, Model E-7, heads #108 and #138, were installed, together with Simplex Four Star Sound and Peerless Magnarc Lamps. This equipment is in operation twelve hours and over every day, seven days each week, and we have yet to have a show held up due to mechanical defects.

Our picture and sound receive commendations. The projectionists in our booth are confident that when better projectors are made International will produce them. This letter is written voluntarily, and you may use it in any way that you wish.

Very truly yours,

Members of Local #159

I. A. T. S. E.

James R. Forsyth
H M Pakwor
P. N. Lunsford
L. G. Wright
J. A. LaViers

E 7
Simplex

AND

Simplex
REG. U.S. PAT OFF

★★★★

Sound

A COMPLETE
Simplex
INSTALLATION

★ **in practical oper-ation 26 month (*nearly 10,000 hour*) without a singl mechanical defec**

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INTERNATIONAL PROJECTOR CORPORATION
NEW YORK, N.Y.

Simplex ★ Simplex
SERVICE SUPPLEMENTS QUALITY

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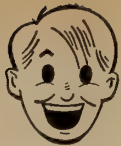
PROJECTIONIST

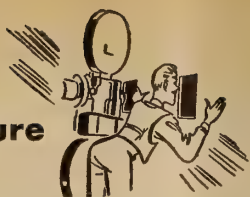
MARCH 1941

VOLUME 16 • NUMBER 3

25c A COPY • $2 A YEAR

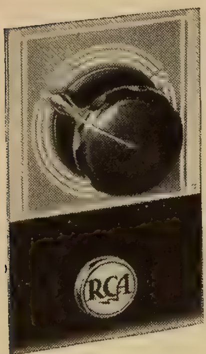
Here's your  **QUIZ, KIDS!**  There's a **POT OF**  **GOLD** awaiting all exhibitors who know these answers. You can **TAKE IT OR LEAVE IT.** But just  remember that today when you think of light it must be **DOUBLE OR NOTHING.** And, now  **PROFESSOR QUIZ,** more  **INFORMATION PLEASE!**

? ? ?	& **ANS.**
Why are so many moderate sized theatres installing the new intermediate capacity high intensity projection arc lamps?	Because today, much more light, snow-white light, is absolutely necessary to the satisfactory projection of colored pictures and present dense black and white films.
Does this mean that low intensity lamps can no longer be used satisfactorily?	It does. Furthermore, there is no longer a reason for theaters with screens up to 18 feet in width denying themselves the vivid brilliancy of high intensity projection.
But why didn't they replace their low intensities with high intensities before now?	Because, up to the time the Strong Utility was introduced, the operating cost was considered prohibitive by many of them.
How much more light does the Strong Utility project?	Twice as much as any low intensity lamp, but this is not all . . . it projects light of the same characteristics as that used in the studios where the pictures are shot.
. . . and does this doubling in light double the operating cost?	No. Strong has made it possible at an increased combined current and carbon cost of less than 2c an hour.
Who sells Strong Utility lamps?	Your Independent Theatre Supply Dealer. He'll arrange a demonstration in your theatre without obligation.
Who manufactures them?	The Strong Electric Corporation, 2501 Lagrange Street, Toledo, Ohio.

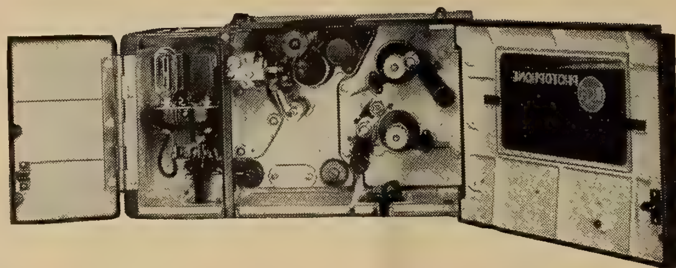
Looking at the sound picture  from the projectionist's port-hole

RCA PHOTOPHONE MAGIC VOICE OF THE SCREEN

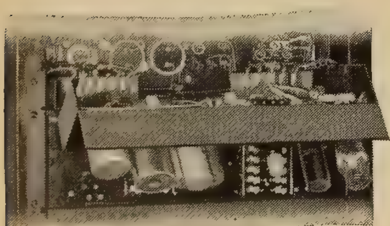
—Designed for greater operating convenience!



● *Positive grip control knobs.*



● *Emergency switching and quick* individual *tube check.*



● *Easily accessible—hinged amplifier chassis.*

● Among many helpful operating features of RCA Photophone standard and de luxe soundheads are included the roomy threading compartment, white interior finish for ease of observation, double exciter lamp socket with cool grip, prefocused exciter lamp, socket mounted photocell, door glass, and adjustable mounting plate accurately machined.

● *Handy soundhead framing wheel and handbrake on flywheel-equipped soundheads.*

MANY operating features of RCA Photophone equipments are the result of suggestions made by projectionists. We hope you will continue to send them in. Your long experience "on the job" offers opportunity for valuable suggestions in the way of providing better projection room equipment, designed for improved operation, and for greater operating convenience.

The units of RCA Photophone equipments illustrated are but a few of the operating convenience features incorporated in RCA equipment design. These features are the result of consideration given from a practical projection room operating standpoint. All have been provided for greater ease of operation, assistance in routine work, and in emergencies, thereby reducing operating problems.

RCA VICTOR PREFERRED TYPE RADIO TUBES
For Finer Radio Performance

Better sound means better box office—RCA Tubes mean better sound

AT YOUR SERVICE

RCA Photophone field engineers are always ready and eager to serve you. Backed by RCA research and experience in sound recording and reproduction, the engineer near you will be happy to help you with any problems you may have—and in addition, solicits your suggestions and criticisms for further improvement of RCA Photophone Equipment—the best in the business!

RCA THEATRE SERVICE

PHOTOPHONE DIVISION

RCA Manufacturing Company, Inc., Camden, N. J.

In Canada, RCA Victor Co., Ltd., Montreal   A Service of the Radio Corporation of America

International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

***Edited by* James J. Finn**

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Monthly Chat

THE while the technical branch of the motion picture industry awaits with bated breath the promulgation of standards relative to control-track sound recording and reproduction, F. H. Richardson pops a question that should restore a little sanity and balance to the muddled thinking on this topic. Queries "Rich," in effect:

"This new-fangled sound is undoubtedly great stuff and, like any technical advance, cannot but help the industry. However, before promulgating standards and calculating costs to exhibitors, let's pause and ask ourselves just how many theatres have installed the vastly improved two-way equipment that has been available for the past several years.

"Careful checking reveals that out of a total of some 15,000 theatres in the U. S., only 4000 at most have really modern sound equipment. What about the other 11,000? Will they have to modernize their equipments to date, and then pile on top of that such improvements as are necessary for rendering control-track sound?"

"Rich" is, of course, 100% correct on this angle. He need have added just one more question to do the job up brown, *i.e.*, "And will they do it?"

• • •

Not the least interesting current development is the growing strength of the proponents of shorter film programs. Numerous local communities and at least two states are considering legislation to restrict program length—backed, they assert, by competent medical authorities who profess to see danger in 3-hour and longer programs. On the Hollywood front, Hal Roach announces plans for the production of 50-minute pictures designed to supplant the second feature on the program. Another angle is the effort to require by law an intermission between each complete program. Alas, poor bank night.

• • •

Driving ahead with a vengeance are the RCA gentlemen charged with the development of theatre television. So rapid has been their progress that even our enthusiastic forecasts of several months ago have already paled by comparison with actual accomplishment. Of which more elsewhere in these pages.

• • •

The shortage of necessary material still is plaguing projection equipment manufacturers. This is no gag, designed to spur sales, but an acute reality. If you want equipment now or within the next couple of months, now is the time to step up and say so.

• • •

Itinerant 16-mm shows using reduction prints of not-so-old features continue to plague the theatre exhibition field. Insistence by the organized craft that such shows use competent projectionists is one way to combat this menace.

INTERNATIONAL PROJECTIONIST

VOLUME XVI MARCH 1941 NUMBER 3

Some Common Projection Troubles Due to Power Line Deficiencies

By *LEROY CHADBOURNE*

AN experienced projectionist, glancing over Fig. 1, will say at once that it is wrongly fused—but his experience will also tell him that a great many projection rooms are wrongly fused in much the same way and for much the same reason.

When a fuse went out in the switchboard represented by Fig. 1 the crew was luckier than in some cases, because loss of the two ceiling lights did not leave the room completely dark. There was a lamp over the rewind bench, and some other illumination, all wired to another switchbox in the same room. The projectors continued to function, although sound went off.

As often happens, the crew didn't know off-hand which switchbox controlled which circuits, so they fumbled in the dim light provided by the rewind bench lamp. Eventually it was found that the 20-ampere switch fuses felt hot. Replacements lasted only a short while, and again the show was interrupted.

That was when the crew began to really study the switchboard. The wiring arrangements, as in many theatres, had been revamped from time to time when equipment changes were made, and the blueprint in the switchbox door had not been altered to show those changes.

A request for overtime to run down the circuits and make a new blueprint would undoubtedly have been denied.

After fuses had been replaced for a third time it was decided that one man would keep the show going while the other concentrated on the trouble. Speed was essential because each fuse replacement lasted only about two minutes. At the next blow-out 30-ampere fuses were installed, following which the trouble ceased.

It was decided to see if 30-ampere fuses were really safe in those clips. The trouble lamp was called on for a closer inspection of the switchbox . . . Its reel-case was too hot to touch!

This is what had happened, according to subsequent revelations: The trouble-lamp reel was very old, and should have been replaced long ago. Meanwhile it had developed a temporary internal short. The original fuses in the line supplying the lamps — probably 3-ampere, as they should have been—were boosted to 10-ampere size, and whoever was working on the job thought that was fine and forgot all about it. An ohmmeter test on the disconnected trouble lamp showed that when the reel was in certain positions an internal short of a little more than 20 ohms was created. That short took about 6 amperes, which went to heat up the reel and reel case. The total drain of about 7.5 amperes, in that line, was not enough to blow out the line fuses, which had been boosted to 10 amperes.

But a total of 7.5 amperes in that line, plus 15 in the amplifier and rectifier, sent a total of 22.5 amperes through the 20-amp. switch fuses; of course they couldn't take it. The 30-amp. substitutes took it without trouble, but represented another case of boosting. The wiring into that switchbox proved to be No. 12 rubber-covered, which is rated for only 25 amps.

Power Line Hums

A new trouble-lamp reel was ordered, and the fuses were all reduced to their proper ratings. The correct fuse rating was marked above each set of clips with red china marking crayon (subsequently with India ink, which resists heat and time) and a new drawing was made, similar to Fig. 1, and mounted inside the switchbox door.

An example of hum trouble created by power line faults is diagrammed in

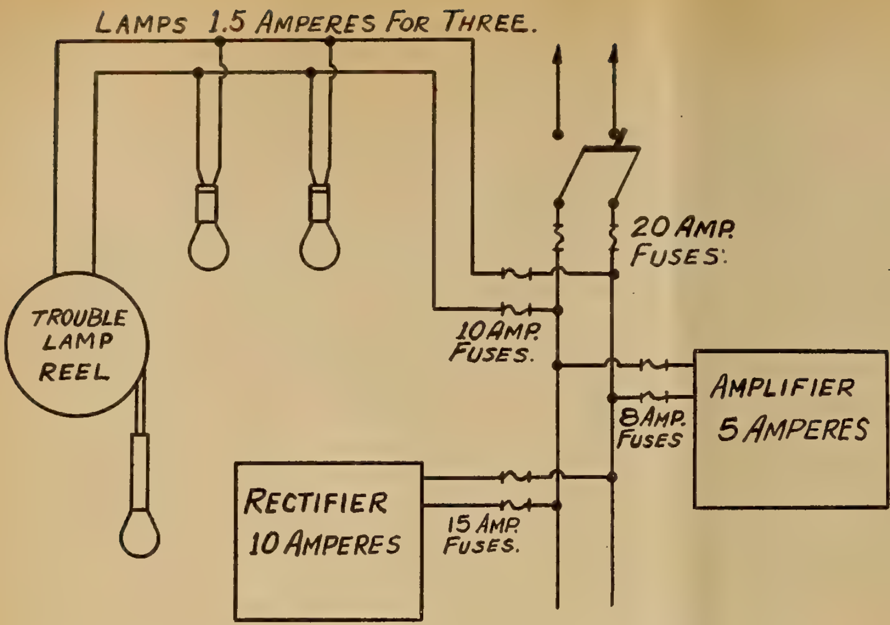


FIGURE 1

Fig. 2. This was an old theatre in a downtown neighborhood, surrounded by other old buildings, all supplied from the same power mains. Nobody knew or could find out what old, dead wiring there might be in the theatre itself, let alone in the surrounding buildings. The power company, whose aid was enlisted, was not too well informed about old, forgotten, dead-end changes which may have existed in its own lines.

The P.E.C. and its amplifier were supplied with plate power from the power pack in the main amplifier through a conventional circuit, as shown. Hum of power line frequency developed somewhat erratically over a period of months, ultimately becoming constant. Trouble-shooting during the first period proved unsuccessful, the hum disappearing while tests were being made but returning at unpredictable times.

Very extensive tests made after it became constant included disconnecting all power and running the main amplifier by a rotary converter driven by a storage battery. Next, the power pack in the main amplifier was disconnected, the amplifying circuits being supplied by storage battery and B batteries. When this was done, A.C. fuses were pulled in the cellar switchboard, so that there was no line power in the house at all. Still the A.C. hum continued.

Power companies have detectors built on radio principles. A man in a car follows a power line with one of these detectors looking for indications of leakage, which represents waste, of course. The fact that hum was heard in the system with no power at all in the theatre was demonstrated to the utility company. They decided that line leakage was responsible and assigned an engineer with a detecting device to scour the neighborhood. The trouble was not found. However, the trouble in the sound system was cured with the help of an improvised diagram, similar to Fig. 2, which represented the *probable* conditions.

The unknown, dead wiring connected to the power circuit both inside and outside the theatre is represented by the dotted lines at the lower right of the drawing. It was assumed that somewhere along those dead lines old rubber insulation had deteriorated, or other fault occurred, producing first an intermittent and finally a permanent, high-resistance ground to the "live" side of the line. This condition may have been outside of the theatre; or it may have been in the theatre despite the fact that the trouble continued after meter fuses had been opened. There may have been other, forgotten power leads brought into that house several years ago and long since abandoned.

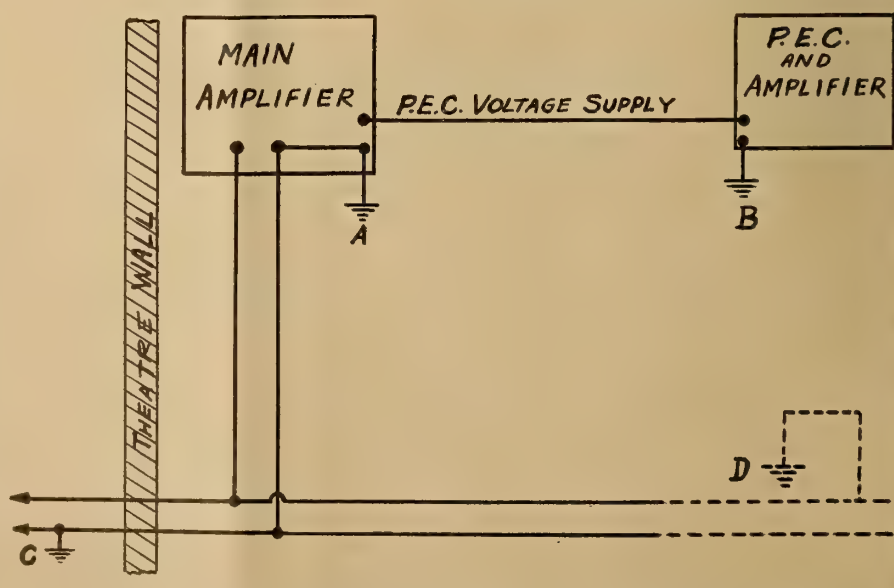
With a high-resistance ground at *D*, earth currents would flow from *D* to *C*, the normal power ground connection. These currents would divide according to the resistance of the various paths open to them, flowing through old piping in the theatre, *etc.*, and a branch of them might flow between the two sound system grounds *A* and *B*. Hence, *A* and *B* can be regarded as terminals for a source of potential, between which current will flow.

The P.E.C. itself (not shown) returned to its amplifier through the shell of its coaxial cable, and probably was not affected. But assuming *A* and *B* to be sources of an A.C. potential, and assuming the ground connection between them to have some appreciable resistance, a small parallel current might flow through the positive P.E.C. voltage supply line. It could not be more than a fraction of a microampere because there is one-half million ohms in series with that line.

Nevertheless, a microampere at the photocell undergoes a lot of amplification before it reaches the speakers. The P.E.C. voltage supply line and the ground at *B* were disconnected, and the cell and its amplifier supplied by B batteries. The hum promptly dropped to about one-fifth its former volume.

More permanent repairs were effected by restoring the normal P.E.C. power supply, removing the ground at *B* entirely and, instead, returning to the ground at *A* through a No. 10 wire carried in conduit. A residuum of hum remained, but was not considered serious enough to justify further work in view of the expense involved up to that point. Neither would the management authorize further expenses to find out whether the tentative diagnosis based on Fig. 2 was correct. The hum was materially

FIGURE 2



reduced; future troubles could be tackled when they happened!

Power Line Pickup

Somewhat similar to the aforementioned case was the problem in a theatre located fairly close to a radio "ham". From time to time he was heard distinctly "Calling CQ". He was properly licensed to transmit and his equipment met all F.C.C. specifications. An investigation of the shielding and leads of the theatre equipment indicated little possibility unlikely that he was being picked up by any grid wiring acting as a short-wave antenna, but more probably by induction through the power circuits.

Several steps gave temporary and partial relief. One was the inclusion of a radio frequency choke coil in series with the power supply to the sound system. This coil consisted of 12 turns of No. 12 wire on a $1\frac{1}{2}$-inch cardboard core. Stretching or telescoping the coil changed the degree of its effectiveness. The wires were finally shellacked to the cardboard at the spacing between turns which had proved most helpful. Underwriters probably would not have approved, and the arrangement was not too effective.

A further step was to wind a dozen turns of insulated wire around the power conduit, grounding one end of the coil to the conduit and leaving the other end free. This also helped — but not enough. A permanent cure was effected at the cellar switchboard. Two separate lines came into the theatre, and the entire projection room wiring was transferred to the other line.

Related in cause and remedy was a trouble which appeared suddenly one Spring morning in a large city theatre, half an hour before the first show, while loudspeakers were being tested. It manifested itself as a series of thumps or loud clicks lasting about five seconds.

The trouble occurred a number of times during the day, but nothing was done about it until after the last show. Then every tube was tapped, every panel and cabinet rapped or shaken, every available wire tugged in an effort to find something loose or some unstable connection. Nothing was found. The trouble never lasted long enough to be considered really serious. It was decided to keep a log of it next day, noting the times it occurred, the intervals between occurrences, and particularly which projector was operating at the time.

Next day the trouble lasted long enough to show that it could appear with either projector operating. It did not recur for about a week. The solution was provided not by a projectionist but by the manager. The latter knew that the trouble appeared the first day the cooling system was started, ceased during the succeeding cool days, and returned when the cooling system was returned to operation. The projection chief was doubtful, pointing out that the same cooling system had been used in previous years with no trouble.

The manager sent for the house engineer and asked what changes had been made in the cooling system that Spring. It developed that some changes had been made in the theatre power fuseboard, and an automatic motor starter had been wired to the same line that supplied the projection room. This change was reversed the following night, ending the trouble. Nobody ever traced wiring or grounds to find out just how the relay clicks of the automatic starter got into the sound system.

In the same category, but easier to solve, was a disturbance arising from the installation of a new marquee. No sooner was the flasher put into operation than the clicking of its contacts came distinctly through the stage speakers. In this case, of course, there was no room for doubt as to what had happened. The marquee man still was on the job. He made some adjustments, the details of which he preferred to keep to himself, and the trouble stopped. Nevertheless, the chief projectionist insisted that the flasher be transferred to the other side of the three-phase power input. This was done, and this particular trouble did not recur.

Common Overloading Faults

Among many instances of trouble of the type now to be considered, the most serious the writer recalls occurred in a suburban theatre which used three times as many tubes as it should have, and complained that in general its projection room equipment was poor throughout, constantly breaking down in one way or another.

The Raytheon voltage stabilizer

Inspection of the equipment revealed no specific fault. Those sockets of the sound system in which tubes gave way most frequently were checked with special care. All voltages were normal. A complete routine test of the whole projection room installation revealed normal conditions. Yet the theatre's percentage of trouble was unquestionably far higher than it should have been. There just had to be a reason.

Projection crew and the manager insisted that the line voltage was normal. That point had already been suspected. On two separate occasions the power company had sent an inspector with a portable A.C. voltmeter and checked the line. Nevertheless the projection crew reported that at times the plates of some tubes went orange-hot, and sound system meters gave improper readings. At such times sound was distorted. Arc rectifier meters also gave off readings at times, although there was no particular trouble in keeping the arcs steady. They suspected line voltage trouble, yet couldn't see how it might exist when it had been checked twice and no fault found.

With great reluctance, and only after considerable insistence, the power company agreed to lend the theatre a recording voltmeter for one week. The leads were merely clipped to the blades of a main switch (similar to the switch of Fig. 1) and the meter itself left on the floor directly under the switchbox, where it was not likely to be damaged. The porter was instructed not to touch it with his broom, nor to sweep toward it.

When the paper graph was removed at the end of the week it showed long periods in the middle evening with voltages as high as 135 (on a 110-volt line) and long periods in the early evening with voltages down to 85 as an extreme low. In the afternoons, however, when the previous brief tests had been made with a simple voltmeter, the reading was always between 110 and 120.

The condition was easily explained, less easily cured. The utility company simply didn't have enough equipment to take care of the peak demand of early evening. At that time, jacking up their machines all they could, the best service they could give was 85 volts. When the demand fell off, around 9 p.m., they did not cut their generators down very promptly, and for a considerable period thereafter the line delivered excessive voltage.

A pair of voltage regulators, which the theatre had previously refused to consider because they were considered unnecessary, put an end to the inordinately high average run of troubles in this projection room.

'G. W. T. W.' ALL-TIME CHAMP

"Gone With The Wind" as of last weekend has a total gross of $30,870,000 for its roadshow and general release payoffs throughout the world, with a large percentage of the general release engagements not yet played. On the basis of this figure and the consistenly strong attendance it is estimated that its earnings will total $35,000,000.

Now holding all known records for gross earnings, it is unlikely that the David O. Selznick production will ever be topped. A costume and era picture, it will never become dated, making periodical reissues a possibility.

Effect of Abnormally High Filament Temperature on Tube Life

By C. W. SCOTT, *Altec Inspector, Minneapolis, Minn.*

ALTEC Inspector J. B. Pesek's recent item in I. P.[1] on the importance of operating certain types of vacuum tubes at the proper filament temperature has induced from the field a number of comments on this very interesting subject. Some of these commentators reason that if operating at abnormally high filament temperatures shortens the life of the tube, why doesn't operation at below normal filament temperature lengthen life? Appended hereto are some observations contributing to a further understanding of the problem.

One of the steps in the design of a tube is to test samples of preliminary design at several filament temperatures above and below the design objective. If it is found that best life is obtained at something other than the desired temperature, the filament is redesigned in order to provide optimum life at the design objective. This applies to a filament temperature maintained constant throughout the tube's life.

It is generally acknowledged that high filament temperature shortens life, and often it is erroneously assumed that lower than normal temperature promotes long life. The electrons emitted from a hot filament form a cloud (space charge) in the vicinity of the filament, and the electrons which make up the plate current are drawn from this cloud. The cloud has a negative charge and thus protects the filament surface from the high-voltage gradient produced by the voltages applied between the elements.

Such protection has an important bearing on life of the active surface. At low temperatures the cathode emits fewer electrons and the protective cloud is consequently less effective, although the same plate current may be observed.

It is probably true that lower temperatures will promote tube life provided the space charge is not so greatly reduced that its protective property is impaired. Some reduction of filament current should ordinarily be permitted in new tubes. An ideal arrangement would seem to consist of starting tubes at low filament current and increasing the current as the emissive efficiency of the cathode falls off. The plate current in itself is an inadequate indicator of the presence of a suitable space charge for proper filament protection. However, the change in plate current resulting from reduction of filament current from the maintained value would probably constitute a satisfactory indicator.

Increase Current Gradually

It is therefore suggested that if the problem of maintaining similar tubes in a group having a common filament current can be solved, the tubes be started at a current 10% below normal and that this current be increased as the activity of the tubes falls off. The final value may be somewhat above normal, but caution should be exercised in using high currents due to danger of burn-out and show interruption.

The filament current reduction tests should be used to indicate the required operating current from time to time. A drop of 30 mils from the existing operating value should be the basis of the test rather than the change from 300 to 270 mils.

It would seem that practical difficulties would interfere with the application of the aforementioned method of operating 264-type tubes. However, if these difficulties can be handled, there may be something in the idea.

The foregoing discussion dwells upon the ability to operate at a particular critical filament temperature to insure long life, and refers to vacuum tubes that are designed primarily for theatre operation such as the W. E. 264-type. Vacuum tubes of the common radio type must necessarily be designed for operation over a wide range of conditions, since the circuits in which they operate normally have no provisions to adjust for line voltage fluctuations, drop in voltage of battery-operated automobile radios, *etc.* These latter type tubes thus are handicapped in their ability to consistently give long life.

[1] *"Abnormal Operation Shortens Tube Life,"* in I. P. for Nov., 1940, p. 32.

STUDIO CRAFTS' 16 CONDITIONS FOR NEW WORK PACT

Sixteen conditions applicable to all studio crafts in negotiations with studios for new contract affecting Los Angeles locals which recently abandoned individual parleys for collective bargaining are:

(1) Computation of daily overtime; (2) Computation of Sunday time; (3) Computation of holiday time; (4) Conditions where men are called more than once a day; (5) Provisions for working in a higher classification; (6) Provisions for employes receiving above scale; (7) Provisions for ratio of apprentices and helpers; (8) Cancellation of calls; (9) Minimum calls; (10) Pay off requirements; (11) Provision for "keying" for troupe work; (12) Computation for pay when "keyed"; (13) Meals and meal period provisions; (14) Provisions for nearby locations; (15) Provisions for distant locations; (16) Provisions for travel time.

F.C.C. TO LIFT TELEVISION BAN

Federal Communications Commission officials indicated that the ban against commercialized television will be lifted. Two tele achievements were given as reasons for the Commission's change of view: difficulties in the synchronization "pulse" from the transmitter to the receiving set have been overcome, as has the transmission of images of a suitable size and clarity.

SEAGLE JOINS ALTEC IN ROANOKE

Altec Service has added George P. Seagle, of Norfolk, Va., to its staff of service inspectors. Seagle formerly worked for Erpi and DeForest, and has been assigned to Altec's Roanoke service area.

Huddle on equipment at International Projector Corp. From left to right, A. E. Meyer, General Sales Manager; Paul E. Kline, manager of Panama Canal Club Houses, and P. A. McGuire, Advertising Manager of I. P. C. Mr. Kline, formerly a member of Columbus, Ohio, Local 386 of the I. A. and subsequently a member of the Canal Zone Local, has been manager of the Canal Zone government-owned-and-operated club houses since 1935. There are now 11 club houses, with 3 more being built.

PLAIN FACTS

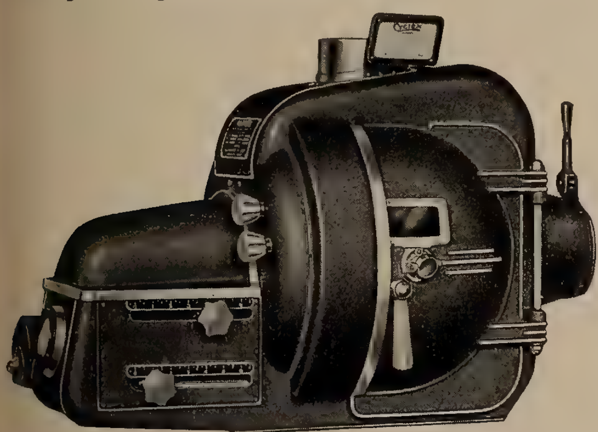
ABOUT PROJECTION LAMPS FOR THE PROJECTIONIST

Since the introduction of Cyclex in 1939 there has been a great deal of discussion, largely among the unqualified, regarding the comparative merits of Cyclex and the so-called Intermediate High Intensity (Direct Current) Projection Lamps.

C. S. Ashcraft Mfg. Co., as the only lamp manufacturer who builds both Cyclex and Intermediate High (Suprex) Lamp arcs, undoubtedly are qualified to give an absolutely unbiased comparison of these two light sources. The appended information will help the exhibitor select the Projection Arc most suitably adapted to his particular theatre.

WHERE Cyclex SHOULD BE USED
(ALTERNATING CURRENT)

We strongly recommend Cyclex for theatres having screens of 18 feet or less in width. Why? Because its first cost and operating cost is much less than with Direct Current Arcs and the light is equal to, if not better.



Cyclex ONE KILOWATT PROJECTION LAMP

INITIAL COST—Comparable to intermediate high and tube rectifiers much less than intermediate high and generator.

OPERATING COST—Less than intermediate high or any other type of carbon arc due to less carbon waste, slower burning, and minimum power consumption.

LIGHT—Somewhat greater than intermediate high when latter is operated at 40-42 amperes 27½ volts. However, for Technicolor pictures no type of light can compare with *"CYCLEX"* quality.

STEADINESS OF LIGHT—No high intensity light source ever devised can compare with *"CYCLEX"* for smoothness.

LIFE OF LAMPS AND POWER UNIT—Should outlast the theatre, with minimum replacement cost.

SUMMARY—The medium and small theatre where excellent light with economy is demanded are served best by *"CYCLEX."*

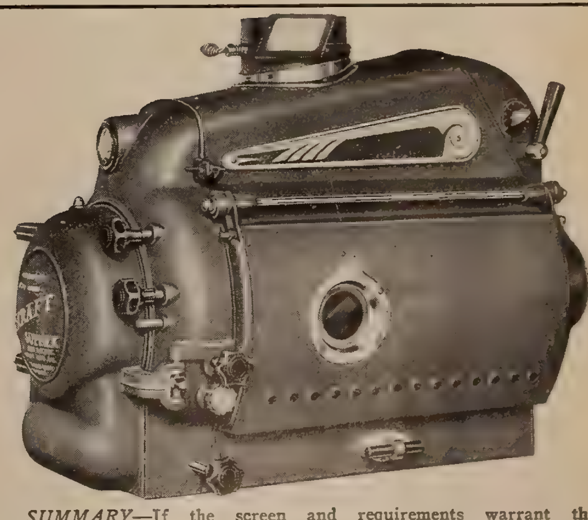
WHERE *SUPREX* INTERMEDIATE HIGH SHOULD BE USED
(DIRECT CURRENT)

We recommend the Ashcraft "Suprex Special" DC Projection Arc for screens 19 to 22 feet in width. Of course, the operating cost will be proportional to the light required. We caution the exhibitor against the purchase of any DC Arc not having means of adjustable ratio carbon feed.

LIGHT—Where a variable quantity of light in the higher ranges for screens 20 feet in width and over, where economy is of less importance, the Ashcraft Suprex Special is ideal. Current of from 40 amperes upward to 50 amperes may be used.

OPERATING COST—In the lower ranges 40-42 amperes somewhat greater than *"CYCLEX."* In the higher ranges, 45-50 amperes, the cost of operation is commensurate with the light produced. You get just what you pay for.

REMEMBER—The flexibility of light is obtainable only with a Suprex lamp having adjustable carbon feed ratio as in the Ashcraft Suprex Special. *Lamps having a single feed screw are limited to one narrow current range.*



SUMMARY—If the screen and requirements warrant the higher operating and first cost, and economy is of less importance, then we recommend Intermediate high, but be sure you select a lamp with a 14-inch mirror—adjustable carbon feed ratio—one that was designed as a *SUPREX LAMP* and not a *converted low intensity lamp.*

C. S. ASHCRAFT MFG. CO. 47-31 35TH STREET, LONG ISLAND CITY NEW YORK, U. S. A.

A. S. A. 'Recommended Practice' For Motion Picture Projection

THE appended data applicable to motion picture projection has been listed as "American Recommended Practice" by the American Standards Association, following the recommendation of the Section Committee on Motion Pictures, of which the Society of Motion Picture Engineers is one member. These data supersede all previous publications anent these topics.

Projection Optics Data

Projection Lens Height.—The standard height from the floor to the center of the projection lens of a motion picture projector should be 48 inches.

Projection Angle.—Should not exceed 12 degrees.

Observation Port.—Should be 12 inches wide and 14 inches high, and the distance from the floor to the bottom of the openings shall be 48 inches. The bottom of the opening should be splayed 15 degrees downward. If the thickness of the projection room wall should exceed 12 inches, each side should be splayed 15 degrees.

Projection Lens Mounting.—The projection lens should be so mounted that the light from all parts of the aperture shall traverse an uninterrupted part of the entire surface of the lens.

Projection Lens Focal Length.—The focal length of motion picture projection lenses should increase in $\frac{1}{4}$-inch steps up to 8 inches, and in $\frac{1}{2}$-inch steps from 8 to 9 inches.

Projection Objectives, Focal Markings.—Projection objectives should have the equivalent focal length marked thereon in inches, quarters, and halves of an inch, or in decimals, with a plus (+) or minus (—) tolerance not to exceed 1 per cent of the designated focal length also marked by proper sign following the figure.

Screen Size, Placement

Sizes of screens shall be in accordance with Table A. The spacing of grommets shall be 6 inches, with 12 inches as a possible sub-standard. The ratio of width to height of screens shall be 4 to 3.

The width of the screen should be equal to approximately 1/6 the distance from the screen to the rear seats of the auditorium. The distance between the front row of seats and the screen should be not less than 0.87 foot for each foot of screen width.

Number of Teeth in Mesh.—The number of teeth in mesh with the film (commonly referred to as "teeth in contact") shall be the number of teeth in the arc of contact of the film with the drum of the sprocket when the pulling face of one tooth is at one end of the arc.

Safety Film Designations

The term "Safety Film," as applied to motion picture materials, shall refer to materials having a burning time greater than 10 seconds and falling into the following classes: (*a*) support coated with emulsion, (*b*) any other material upon which or in which an image can be produced, (*c*) the processed products of these materials, and (*d*) uncoated support that is or can be used for motion picture purposes in conjunction with the aforementioned classes of materials.

The burning time is defined as the time in seconds required for the complete combustion of a sample of the material 36 inches long, the determination being according to the procedure of the Underwriters Laboratory. This definition was designed specifically to define Safety Film in terms of the burning rate of the commercial product of any thickness or width used in practice.

The test of burning time, therefore, shall be made with a sample of the material in question having a thickness and width at which the particular material is used in practice.

All 16 and 8-mm film must be of the safety type.

Fader Setting Instructions

The Fader Setting Instruction Leader shall consist of 15 frames located in the first 20 frames of the synchronizing leader: the first frame shall designate the type of print; the second frame the type of reproducing equipment necessary to project the print; and the next nine frames the general fader setting specified in relation to an average fader setting for the particular product under consideration. The remaining frames may be used for whatever additional information the studio may wish to transmit to the theatre.

The designation "Regular" in the Instruction Leader indicates that only one type of print has been issued on the particular production under consideration. Productions with prints designated as either "Hi-Range" or "Lo-Range" are issued in both types of prints, *i. e.*, all productions on "Hi-Range" prints will have necessarily been issued on "Lo-Range" prints as well.

Both the terms "push-pull" and "single" shall be on every leader, one or the other being crossed out to leave the proper term designating the type of sound-track on the print.

The Standards Committee of the S. M. P. E. has recently announced the following change in recommended practice relative to screen brightness:

"Screen Brightness.—The previous SMPE Recommended Practice for screen brightness, published in the March, 1938, issue of the Journal indicated 7 to 14 ft.-lamberts at the center of the screen, when the projector was running with no film in the gate. The recently approved specifications changes this range of brightness to $10\pm^{4}_{1}$ ft.-lamberts."

PARAMOUNT'S EARNINGS SOAR

Paramount's total net earnings for 1940 were more than $2,500,000 above those of 1939. Consolidated earnings for the year ended Jan. 4, 1941, were $6,304,064, and discount of purchase of debentures was $98,066, bringing the total to $6,402,130.

The consolidated results of $6,402,130, after deducting annual dividends of $1,124,620 on the first and second preferred shares outstanding on Jan. 4, 1941, were equal to $2.14 per share on the 2,465,927 shares of common stock outstanding on Jan. 4, 1941.

During the year the interest bearing indebtedness of the company and its consolidated subsidiaries was reduced by approximately $3,900,000.

Screen Sizes

TABLE A

Screen sizes referred by Sectional Committee to the A. S. A. as 'American Recommended Practice'.

Size No. of Screen	Picture Width (Feet)	Picture Height, Feet	Inches	Size No. of Screen	Picture Width (Feet)	Picture Height, Feet	Inches
8	8	6	0	25	25	18	9
9	9	6	9	26	26	19	6
10	10	7	6	27	27	20	3
11	11	8	3	28	28	21	0
12	12	9	0	29	29	21	9
13	13	9	9	30	30	22	6
14	14	10	6	31	31	23	3
15	15	11	3	32	32	24	0
16	16	12	0	33	33	24	9
17	17	12	9	34	34	25	6
18	18	13	6	35	35	26	3
19	19	14	3	36	36	27	0
20	20	15	0	37	37	27	9
21	21	15	9	38	38	28	6
22	22	16	6	39	39	29	3
23	23	17	3	40	40	30	0
24	24	18	0				

RCA Theatre Television: Program, Cast and Effect on Film Industry

By *JAMES J. FINN*

DEFINITE indication that RCA is in deadly earnest anent its plan to push theatre television to the limit, and complete substantiation of the forecasts relative to this development which have appeared in these columns in recent months, were forthcoming at a recent get-together at the Waldorf-Astoria in New York of RCA commercial and technical television representatives and editors, executives and writers of the trade press, at which time RCA took the wraps off its plans for this new art.

The gathering was a prelude to the forthcoming demonstration of theatre television at the New Yorker Theatre on May 9 at which time there will be projected onto a 15 x 20-foot screen a televised record, with sound, of the Billy Soose-Ken Overlin world's middleweight championship fight originating a few blocks away in Madison Square Garden, in addition to other material.

Great significance is attached to the *piece de resistance* of this demonstration because it lends pointed emphasis to RCA's intentions in the way of program stuff once theatre television gets under way. Which is to say that sporting events will be used as the main lure for the cash customers. For example, it is estimated that in New York City alone there are from three to five sporting events daily—including baseball, hockey, boxing, tennis, racing, etc. — that are more or less "naturals" for television programming.

But first let's see what RCA had to say for itself and its plans for theatre television, in the person of Thomas F. Joyce, vice-president and director of commercial television activities. In response to questions, Mr. Joyce stated that:

Theatre Television Plans

1. Large-screen receivers of the type in use at the New Yorker Theatre, previously described herein, will cost the exhibitor approximately $30,000 for a complete installation all set to go. Reversing the practice employed in merchandising sound picture units, RCA intends to sell the equipment outright, with payments to be spread over a period of years.

2. Fixed weekly "wire charges" of approximaely $200 will be assessed against each theatre equipped, irrespective of whether the equipment is operated or not.

3. "Service charges" will range from $25 to $50 per theatre per week. Service and its attendant charges will be obligatory on the part of the theatre until the equipment is completely paid for.

4. In addition to equipment and service costs, of course, the theatre will have to pay for its televised programs, much in the same way that it now pays for film service. It is estimated that the average television feature would cost the exhibitor from 10 to 20 cents per seat; that special attractions might cost about 40 cents a seat; and that really outstanding events — such as a World's Series baseball game, a championship boxing match, the Kentucky Derby, *etc.* —might be rated at $1 a seat. All such programs would be transmitted by wire, not etherized, thus they would not be available for reception in the home.

5. RCA estimates that not less than 500 theatres will be wired for television within the next five years. The consensus of opinion among those vitally interested in this development is that this estimate is very much on the conservative side.

The Sports Angle

Mr. Joycc, after polishing off these highlights of the RCA theatre television program, proceeded to make several more highly interesting observations. On the basis of his remarks, it is obvious that Madison Square Garden in New York City, and probably its affiliates and counterparts elsewhere throughout the country, are all hopped up about the possibilities of theatre television and are now, or will be shortly, in the RCA bag on an exclusive contract basis for the televising of all sporting events.

Also, and most significantly, Mr. Joyce intimated that the major league baseball clubs—Giants, Yankees and Dodgers—were "appreciative" of the potentialities of theatre television as a sizeable revenue producer. Citing the increased attendance and betting at major tracks throughout the country, plus state moves to obtain added revenue by legalizing betting thereat, Mr. Joyce suggested that matinee racing telecasts in cities lacking tracks, and even in those which have tracks, would benefit the theatre and might enrich state treasuries. "The state" said Mr. Joyce, "might legalize the box office as a betting station in every community."

Naturally, the bulk of such sporting events would be matinee affairs and would be available to television theatres during a period when their grosses are smallest. Another angle of interest to theatres is Mr. Joyce's idea that theatre television might conceivably put an end to all games of chance, giveaways, *etc.* He added that churches today give better Beano and Bingo prizes than do most theatres, and without having to shoulder any tax burden.

Effect on Film Industry

Focusing directly on the question of what effect television would have on the motion picture industry's present setup, Mr. Joyce warned that film people had better set about immediately making plans to "collaborate" with this electronic baby. He added that while NBC was concerned primarily with home television, and the NBC-RCA combine had

300 Attend Simplex Lecture-Demonstration in Pittsburgh

The recent lecture and supper at the Fort Pitt Hotel, Pittsburgh, Penna., arranged by E. B. Morton of the Pittsburgh Branch, National Theatre Supply Co., through Lawrence Katz, I. A. Local 171, was attended by more than three hundred projectionists from Pittsburgh and nearby locals.

The meeting was addressed by A. E. Meyer, General Sales Manager of International Projector Corp., and the lecture on Simplex E-7 Projector was delivered by Henry Heidegger, also of the I. P. C. Among those present were E. B. Morton and A. Baldwin, N. T. S., New York. The great success of this meeting is further evidence of the deep interest projectionists take in lectures and other educational activities relating to their craft.

no present intention of forming television production units, it might find it necessary to do so. Also, it might be well if the film industry developed the theatre program production-distribution field.

On the production side, Mr. Joyce continued, Hollywood could build up interest in pictures by having television cameras on the sets and on location, thus affording itself marvelous exploitation possibilities. In exhibition, a large theatre or a group of theatres could purchase their own television cameras for special exploitation uses.

Thus the RCA attitude regarding theatre television, its possibilities, its cost and its probable effect upon the fortunes of the film industry. A few words of an exploratory character on this setup might not be amiss herein.

Projectionists are naturally interested in just where they get off under this proposed setup. That projectionists will be needed and used on theatre television equipment is a foregone conclusion, probably to the extent of at least two men for each complete program. We have RCA's word for it that a competent projectionist can be trained to operate theatre television apparatus after only a short period of training.

"Well, that's just swell," might be Mr. Projectionist's rejoinder. "But, taking RCA's own figure of 500 anticipated installations within five years, just how many theatre television jobs will be available?" The answer to which query only time can provide. It is certain, however, that even 500 theatre television spots, even if these should supplement their television programs with film shows, will cut heavily into the take of straight film theatres, and will reduce by many hours per week the available time for pictures. The latter, in turn, will be reflected in curtailed production in the studios.

A total of 500 television theatres in operation might conceivably provide steady employment for some 4000 projectionists, calculation being on the basis of two men for each program and split work weeks. One can only guess as to how many additional projectionists could be spotted in studios and in other television work. This is a matter which requires some deep brow-knitting on the part of the organized craft—right now — and no less on the part of studio workers than on the part of theatre employees.

How about the cost of equipment, service, wire costs, programs, and operating personnel to the theatre? Based on RCA's own figures, we find that installation will cost $30,000; wire charges, $200; service charges, say, a median of $35, and labor charges some indeterminable figure which might run to, as a rough guess, $1,200 weekly. The labor cost is, of course, just a stab in the dark, and can be as far wrong in either direction.

The cost of the equipment, the writer feels, can be considered on its own and on a basis comparable with the costs of the early sound equipments. Many readers will recall theatres which paid anywhere from $10,000 to $20,000 for the early sound equipments, and then didn't even own a single screw therein, onto which was tacked service charges ranging from $20 to $40 weekly. Not to mention $40 photo-electric cells and the like.

It is perfectly obvious that any exhibitor who essays theatre television will not be in any nickel-and-dime enterprise. His total overall weekly cost, considering only the operating "nut" and excluding equipment cost, will be slightly on the terrific side. It is the writer's opinion that the aforementioned operating charges will be revised downward once the development is in full swing.

But if they are not? Well, pressed for his real honest-to-goodness opinion as to the prospects of an exhibitor's success on the aforementioned cost basis, the writer would say first that there will be no piddling, halfway measures in the conduct of theatre television: it will be either a sensational success or one of the worst flops ever seen in the amusement field.

Which will it be? On the basis of what he has seen and knows concerning both the technical and commercial development of theatre television, the writer holds that it will be a sensational success—at least at the start, and that, irrespective of what happens when and if the tapering-off process sets in, if it should, enough will have been netted to earn a handsome profit for all concerned.

On one point, however, there exists not the slightest doubt in the writer's mind, and that is that the motion picture industry — including production, distribution, and exhibition—had better tend to its knitting—and fast! Naturally, and most emphatically, the word "industry" includes Labor. Considering the somnolent attitude displayed by the film industry to date with regard to television, there exists scant hope that it will bestir itself on this problem even at this late date and in the face of scores of red flags flying.

Why Theatre Television?

There remains but one aspect of this situation that has not yet been considered, an angle that assuredly must have been in the mind of every reader who has followed along thus far. This is the question turning on the apparent disinclination of the television people to develop the home market at this time, as contrasted with their feverish activity in behalf of theatre television. The answer to which is simple and needs be only very brief:

Home television, like present sound broadcasting, cannot develop paying customers on the receiving end. The entire financial load of production costs would fall upon the very same clients who are now paying plenty for sound broadcasting. It is doubtful if the advertising budgets of even the largest radio accounts could bear this extra burden. The broadcasting companies cannot and positively would not shoulder this load—and this applies particularly to the RCA-NBC combine which has been pumping $50,000 monthly into television development for many months past.

What's the answer? It is that cash customers must be developed. How is this to be done? By showing television where an admission price can be charged. Where a more logical place than existing theatre structures? None. There's your answer.

Theatre television will serve a twofold purpose: first, it will enable the television people to regain the money they have invested in the development of the art to date; second, it will provide an excellent means for the further development of the art as a whole, including home television. The latter will come along when, as and if propitious circumstances present themselves.

And there you are.

MID-WEST FILM BIZ UP 15%

Midwestern film business is up 15 per cent ahead of last year, it is indicated from admission tax reports and statements from exchange and circuit officials. Since Easter, business has improved materially and with a continuation of quality films, exhibs. expect to hold the gains.

Lengthened payrolls in the territory, due to defense manufacturing, have already made their effects felt, while pay increases to Gary, Ind., steel workers, adding upwards of $13,000,000 to 30,000 workers' envelopes, is expected to have a favorable reaction.

ALTEC SERVICE MEN BUSY

"My Son, My Son!" and "Yes, My Darling Daughter" are first-run feature attractions, respectively, in the houses of two Altec inspectors. A boy weighed in at the home of George LeBlanc, Altec man in Waterloo, Iowa, and a girl is providing intermittent sound effects at the J. B. Peseks'. Pesek is an Altec inspector in the Chicago territory.

F-P CANADIAN'S BIG YEAR

Net profits in 1940 of Famous Players Canadian Corp., Ltd., totalled $1,012 270 after all deductions, equal to $2.35 a share common stock.

This compared with $889,723 or $2.09 a share outstanding in 1939. The shares totalled 430,524 in 1940 and 425,524 in 1939. Net profit, reflecting war-time gains in theatre attendance, was the highest for any year since 1930, despite marked increase in taxes.

Coated Lenses in Photography: Their Effect Upon the Screen Image

By *CHARLES G. CLARKE*

MEMBER, AMERICAN SOCIETY OF CINEMATOGRAPHERS

Projectionists are familiar with the results obtainable through the use of coated lenses for projection; but the growing use of these improved optics in the studios requires a radically new conception of set-lighting technique which is destined to exert considerable effect upon the quality of the screen image, particularly in those theatres which utilize modern light sources. The accompanying article discusses this problem from the point of view of a prominent member of the photographic craft.

SINCE the announcement some time ago that glass surfaces could be coated with a transparent material, applied in microscopic layers or laminations, for the purpose of reducing surface reflections, it was immediately seen that this process was one which could be used on photographic lenses with possible benefit.

Most of the major studios proceeded to have a set of lenses or two coated with the new material. It was soon discovered that the coating did more than simply control the unwanted reflections and flare, the most apparent difference being in the added definition, an increase of brilliance or contrast, and, surprisingly enough, an *added* transmission of light. The extra exposure amounts to about a full *f*-stop.

The first two effects are direct results of the anti-flare coating, for it is realized that the interior reflections from the several elements of the modern uncoated lens kick back and forth, greying over the shadows and blurring the sharpness of the focus. Just why an extra layer of not too clear coating applied to the several lens-surfaces should increase the light transmission is more than I understand, except that the higher contrast values apparently increase the exposure.

Changed Technique Required

The increase of contrast and definition were values not expected, and in a measure may be part of the reason why coated lenses are not more generally used than they are. I know of several instances where cinematographers have had lenses coated, but after a few days' use have returned to their uncoated lenses, except for some very long shot or an unusually-lighted scene.

The manner of lighting and of developing the negative for uncoated lenses have long been thoroughly familiar; but it is clear that a new technic must be developed for the coated ones. This is especially true in close-up work. Even with uncoated lenses diffusion - discs, gauze diffusers, and the like, are usually used with medium close-ups and always when large close-ups are made. It would seem that the same rule should apply when using coated lenses, modified by simply adding heavier diffusion to counter-effect the sharper definition of the coated lens.

However, when an uncoated diffusing medium is introduced into the optical system of an otherwise coated lens, most of the benefits of the coating are lost. *The quality of the lens reverts back to that of an ordinary lens.* Unless the lighting-contrast is modified for use with this combination, the result on the screen in the finished production will jump from one value to another quite different when diffused and undiffused scenes are cut together.

The brilliant, well-defined image possible with the coated lens, while having an extremely long range between highlight and deepest black, is not to be confused with that quality generally called "hard" or "chalky," for the coated lens gives a long range of middle tones and "holds" detail in extreme shadows and highlights as no uncoated lens will.

Brilliance, Definition Tops

Though a close-up may be lighted in the extreme key, the high-lighted area renders all of the skin texture; white collars reveal their weave, and yet every detail is visible in the darkest clothes and deepest shadow.

To my mind, this quality of brilliance and definition is far more apparent and valuable than the anti-flare characteristic. One must still avoid photographing into extremely strong sources of light, such as lanterns, flashlights and highly burnished metallic surfaces, though a much greater range in this respect is possible than with the uncoated lens.

Several productions are now showing where use of the coated lens is evident. "Tall, Dark and Handsome," "Tin Pan Alley," "Citizen Kane" and several others are among them. A sensational example of the anti-flare possibilities is in evidence in "Citizen Kane" in those scenes in the Opera House where the camera is directed into the footlights and floodlights that illuminate the character on the stage.

I have recently completed a picture which presented an interesting experiment for the use of coated lenses. The picture is "Dead Men Tell," the latest of the Charlie Chan series. As the title indicates, it is a murder-mystery, and calls for most of the production being photographed in extreme low key effect lightings. As the story permitted an unusual photographic approach, I determined to use the coated lenses for every quality they had in them.

Set Lighting Changes

Rather than endeavoring to bring the contrast and definition more nearly to the customary values of the average production, I went perhaps to the opposite extreme by striving to take advantage of all the definition and brilliance that the coated lenses and the new 20th Century-Fox camera would allow.

[This camera, it must be mentioned, in itself permits unusually well-defined photography because of the shutter placement and silent operation. The camera is not blimped, and therefore there is no need to use a glass window before the lens.]

In "Dead Men Tell," no diffusion was used on any scene, close-up or otherwise, except that in making a sequence of night-exteriors on a dock set a light haze-filter was used for atmospheric effect.

Obviously, of course, in making some of the larger close-ups of the feminine players the strictly literal rendering of the coated lens with no diffusion might be unflattering and hence undesirable. But it seemed to me that we have at hand means by which this can be corrected even without recourse to the conventional photographic diffusion meth-

ods. Therefore I attempted in making these close-ups to control the visual effect through the light-source rather than through the lens, lighting these shots with more of a portrait-lighting style than with conventional cinematographic lighting technic.

The key-light was usually a heavily-silked broadside or rifle, rather than the spotlights generally used. As is well known, the smaller the actual source from which light comes, the sharper the definition of the resulting image will be; and conversely, when the source of light is from a physically large area, the definition of the photographic image is correspondingly softer. This is heightened by the use of heavy diffusing media over the light-source, for this again breaks up the light-rays from a hard beam to a softer flood and tends to "iron out" wrinkles and similar facial imperfections.

This treatment, I found, worked excellently in making these close shots of the ladies. It enabled me to retain the brilliant photographic characteristics of the coated lens, and at the same time create an effect which presented these ladies pleasingly.

In photographing the male characters, especially the suspects, more conventional lighting methods were used. Keg spotlights were employed in the usual manner, with very strong modelling. This took full advantage of the coated lens' characteristics, and gave an effect of strength and masculinity which not only contrasted usefully with the more softly-lit presentation of the ladies, but coordinated well with the dramatic mood of the story.

Front-Lighting Taboo

Another modification in lighting which I found useful was the fact that very little or no front-light was used throughout the picture. For the coated lenses, I have found, have the ability of getting into the shadows in an uncanny manner. Very possibly this characteristic is due to the fact that in eliminating internal flare and reflections, the lens-coating eliminates an ordinarily imperceptible haze which ordinarily veils shadow-detail.

By eliminating this haze, it permits smaller increments of illumination to produce a photographic exposure in much the same way that, as we discovered when faster films came into use, the added exposure-making sensitivity made "spilled light" pick up where previously it could be ignored. At any rate, I found the use of front-light and filler-light less necessary using coated lenses than it would have been using conventional objectives.

This style of lighting would probably not be appropriate for all types of stories, though I feel that the enhanced definition and brilliance would be suitable for more than might at first be expected. We should remember that there are styles in photography, as well as in anything else, and these styles are subject to change.

My personal feeling is that the woozy, heavily-diffused style of cinematography is rapidly becoming a mode of the past. None of us, I am sure, would today count as good photography the excessively-diffused "fuzzygraphs" which fifteen or twenty years ago we considered the last word in photographic art.

In the same way, I feel present-day camerawork is evolving steadily away from even the less obvious diffusion currently in use, to new standards of photographic brilliance and definition. Properly used, the coated lens is a valuable instrument in this modern trend of photography.

BALABAN & KATZ EARNINGS

Balaban & Katz (Chicago) net earnings for the past year equaled $1,526,912, equivalent to $5.62 per share, compared with $4.69 per share for the previous year. Current assets totaled $1,039,974, including $929,327 cash. Current liabilities were $2,048,678. Bank loans and long-term debt increased $469,583, largely from redemption of preferred stock at a cost of $1,396,670, last May.

Speaker Failure Due to Volume Overload

By *E. J. DOOLITTLE, Altec Service Engineer, Baltimore, Maryland*

HERE is a common bit of evil-doing for which there exists not a single valid technical reason. The instance under discussion was the failure of two W. E. 555 Receivers due to overloading by operation at excessive volume. Each of these units was installed on a comparatively short horn of the W. E. 22-A type, which fact was undoubtedly the "secret" of the failure.

First, let's consider what usually causes the failure of a speaker unit. Failure in nine cases out of ten is caused by excessive motion of the diaphragm assembly; seldom is failure caused strictly by a burn-out. The motion of the diaphragm, when reproducing sound, is greater the lower the frequency. At high frequencies the motion is rapid, but the distance travelled back and forth is very minute and places a relatively light mechanical strain on the diaphragm, its voice coil and its leads.

But at the very low frequencies, although the movement is slow, the diaphragm's back-and-forth excursions measure in fractions of an inch when operated to reproduce high volume. Under such conditions a terrific physical strain exists.

The diaphragm of the speaker unit is, of necessity, a very delicate mechanism, being made of very thin-gauge material. The voice coil, as well as the coil's fastenings and leads, are made as light as possible. This is necessary in order to hold to a minimum the mass and inertia of the complete diaphragm assembly. Excessive inertia in operation, of course, would act as a brake to slow down and impede the diaphragm movement, with a resultant decrease in the ability of the unit to reproduce the high frequencies. If the back-and-forth movement of this delicate assembly be excessive, damage to the diaphragm will almost certainly occur: maybe the voice coil will be torn loose, the voice circuit broken open or, in extreme cases, the diaphragm may crack or even burst.

Speaker units ordinarily used with the air-column type horns must be properly "loaded" if damage to the diaphragm is to be prevented when they are operated at high volume. The purpose of the horn is to couple the diaphragm with the external air, and the length of the horn (or of the air column therein) governs the amount of the loading at low frequencies. A horn having a comparatively short air column will provide a safe diaphragm loading for only the higher frequencies. To provide for sufficient loading for the safe reproduction of the lower frequencies requires a horn having an air column of 15 feet or more, similar to the W. E. 15-Type horns.

The effect of the "loading" of the air column on the diaphragm is to act as a cushion to limit the diaphragm's motion, the cushioning being the result of the compression and rarification of the column of air which is set to vibrating by the movement of the diaphragm. The cushion effect tends to prevent excessive diaphragm motion and thus guards against damage to this part due to overloading.

Therefore, it should be remembered that caution must be exercised to not operate at too high a volume speaker units which are attached to horns having comparatively short air columns, that is, *when the entire frequency spectrum, including the lows, is being reproduced through the speaker unit in question*—such as is normally the case with P. A. and one-way horn systems.

Short air-column, high-frequency horns are commonly used in two-way horn systems, but in these cases all the low frequencies which would not be properly "loaded" by the horn are filtered off to the low-frequency unit and therefore do not reach the high-frequency unit.

IP AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

MAKING a regular service inspection—that is, a checkup inspection at regular intervals and without any particular trouble being reported — is not unlike a human being going through a large medical clinic for a general going over. Everything is tested and unsuspected irregularities often are discovered and correction prescribed before a serious breakdown occurs.

Appended is one inspector's "clinical report" turned in on a regular service inspection of a W. E. sound system several months ago.

"WORK DONE: Tested all vacuum tubes, made routine adjustments and inspected apparatus in following equipment: 91, TA-7388 amplifier, 500 amplifier set, 753 control cabinet, exciter lamps, P.E.C. and coupling units, 12-B rectifier, Mirrophonic stage horns, coupling network and associated apparatus, 211 reproducer sets, shafts, gears, sprockets, pad and guide rollers, lens assemblies, prisms, pulleys, drives, belts, motors, and take-up assemblies on Nos. 1 and 2 machines.

"Made full transmission test on system. Found frequency response and gain low on No. 2 machine. This due to oil in KS-7871 lens tube. This was corrected by replacement with new tube supplied from emergency stock at Minneapolis. Cleaned oil from prisms on Nos. 1 and 2 machines, and made readjustments of focus on lens assemblies to assure maximum reproducing efficiency. Removed scanners on both machines, cleaned and adjusted bearings and friction shoes to correct improper operation and assure minimum flutter in reproduction. Tested both scanners upon re-assembling with Altec Flutter Bridge: No. 1 scanner, .25%; No. 2 scanner, .3%—which is well within good operating limits. Cleaned oil from guide roller assemblies and adjusted for proper film guide at scanning apertures.

"Made adjustment of apparatus values in equalizer circuit of 91 amplifier to give better high-frequency compensation. This was found to give more desirable reproduction in auditorium. Made tune-up of response of system with aid of external equalizer and Academy test reel.

"Found non-synchronous equipment attached to system improperly, causing sound distortion because of coupling limit paralleling pickup. This was corrected by making proper connection to 753 control cabinet with DPDT toggle switch. Adjusted volume of machines to equal level in order to provide proper house level from each machine."—R. A. MACDOWELL, *ALTEC, Rochester, Minn.*

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In equipments using relays of the telephone type and also key-type switches the writer has found it very handy to cement a small white card in such a position that when illuminated the various contacting members show up against the same as clear silhouettes.—A. F. SCHNEIDER, *RCA, Kansas City.*

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Here is a time-saver that might be of interest to a service engineer who has not already discovered it. On the W. E. Wide-Range installations the low-frequency speakers are installed on a large flat baffle that is so close to the screen that the engineer cannot get between the baffle and the screen; the screen usually cannot be moved.

When it is necessary to replace a low-frequency speaker, quite often the whole mounting screw turns in the baffle so that the nut cannot be loosened and there appears no way to hold the end on the screen side. In addition, when putting on the speaker unit again, it is usually very difficult to hold the heavy speaker and fit the loose screws into all the holes in the speaker head assembly.

In most baffles there are plugged holes in the baffle for one or more additional speaker units, and by loosening and knocking out the plug the screen end of the screws can be held. In instances where this is possible the screws can be held in place while mounting the new unit by putting in place a quickly detachable clamp (thin), on the rear side of the baffle.—W. H. HOWARD, *RCA, New York City.*

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I have found that defective meters can often be repaired "on the job". Inoperative meters often are "open" at the point where the internal resistor connects to a terminal. Due to the nature of the resistance wire, it does not take a good tinning, at times, and careful resoldering will correct the defect.—R. H. BISBEE, *RCA, New York City.*

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A great number of "intermittent sound" troubles encountered have been traced to imperfect contacts in vacuum tube sockets. Even though the vacuum tube is firmly seated in the socket, loss of sound has occurred at times if the socket contacts have become weakened.

There is reason to believe that the faulty contacts are a result of constant withdrawal and reinsertion of vacuum tubes, particularly when the tube is not held properly when taken from the socket. Octal base tubes should be withdrawn and inserted perpendicularly and care taken not to twist or rotate same during the operation.—A. D. TURNBULL, *D.S.E.L., Montreal, Quebec, Via Altec.*

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Frequently it is unnecessary to operate on one machine simply because the other machine is waiting for a replacement gear. I have recently experienced two instances where the defective machine was kept in operation for several hours by using the following expedient.

The machine is turned in the direction of rotation and the stripped gear is meshed so that it will have a chance to make one complete revolution on the start, and allow the momentum of the mechanism to carry it over the stripped portion. Naturally, such operation is an emergency measure only, but may prove useful in saving the show for a short period of time until such gears can be replaced.—J. A. DAY, *ALTEC, Detroit, Mich.*

[ED.'s NOTE: Keeping the show going justifies almost any expedient, of course, but we just can't "go" for this one. Should both gear tops meet, as would be perfectly possible in these circumstances, or should anything happen to disturb the delicate balance being maintained, the result could be a chain of circumstances that would total far more serious results than a few seconds stoppage between reels. Broken shafts would be almost inevitable, to mention only one serious result.]

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Projectionist Charles Eckert of Pleasantville, N. Y., has solved his reflector pitting problem in an ingenious fashion. At the cost of a dime he obtained a

couple of aluminum measuring cups, imported by Woolworth's, and placed them directly beneath the arc to catch the copper drippings. This is cleaner than using a sand tray, cheaper than steel wool, and effective in reducing pitting; but what Charlie likes most is the measuring line on the cup to tell him when it's full! — S. N. TRENT, *ALTEC, New York.*

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Few managers of houses that have automatic sprinkling systems know that whenever the system is cut off for repair their insurance company must be notified or a fireman assigned, otherwise insurance lapses for the period involved. —W. M. SCHUBERT, *ALTEC, Dover, Del.*

[ED.'s NOTE: Projectionists can "make a hit" with the front of the house by passing this information along.]

ON Erpi Universal Base equipments with the old-style guide rollers and straight gates, especially where Powers or Motiograph projectors are involved, considerable trouble has been experienced with film buckling due to necessarily stiff pusher springs on guide rollers.

At times on Motiograph, which definitely sets too far to the drive side and puts the film drag on the inside instead of the outside guide roller, the roller spring has to be so tight that it pushes the film out of the outer guide roller and of course causes frame line noise and, at the same time, film buckling if it does *not* run out.

To overcome this trouble, I find that the guide roller spring can be made good and stiff to keep the film against the outside roller. Then, if a thin washer is inserted between the two halves of the guide rollers (just the proper thickness so that when pushed together the flanges of the guide rollers will be just standard film width and can go no closer together), it will cause no film buckling, nor can the film be pushed out of the rollers.

You will note that on Powers and on Motiograph the film comes *straight down* into the guide rollers, which makes the film ride the outside of the roller flanges; whereas on Simplex jobs the film comes into the rollers at an angle from the lower sprocket, which makes the film ride the *inside* of the roller flanges.—EMIL DE NEUF, *RCA, Kansas City.*

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The characteristic, or frequency output, of a speech circuit will often be influenced in one manner or another if another circuit or piece of electrical apparatus is shunted across it. The usual effect of such shunting is to change the total elements of the circuit so as to change the frequency characteristic of the sound being reproduced.

An accidental upset of the frequency spectrum of this nature is illustrated by a trouble call received from Plymouth, N. C. The theatre reported that the sound was very "bassy" and contained no high frequencies at all. An RCA system including a non-sync and an MI-4283-D amplifier was being used. What was happening was this:

A relief projectionist who was not very familiar with the particular system had left the non-sync plug into the MI-4283-D amplifier. This paralleled the non-sync pickup across the system amplifier and introduced equalization which cut out the high frequencies from reproduction. When the projectionist removed the non-sync plug, the reproduction returned to normal.—F. B. MEWBORN, *ALTEC, Norfolk, Va.*

HERMAN A. DeVRY

Herman A. DeVry, 65, head of the Chicago corporation bearing his name which manufactures numerous motion picture devices, died suddenly on March 23. He is survived by his widow, Ida, two sons, William and Edward, and a daughter, Mrs. Emma Carlson. The business will continue operating under the direction of the sons.

Born in Germany, DeVry came to this country with his parents in 1885 when he was only nine years of age. His first business venture was the selling of barber's supplies in Texas when he was 18 years old. On the side he ran "motion picture" shows in Galveston, Texas, and in Bisbee, Ariz. Then followed a bicycle repair shop in Denver and an electrical fixture shop in Tulsa, Okla., where he became official city electrician. Subsequently he built intricate stage apparatus for use by Harry Keller, Howard Thurston and other noted magicians.

In 1911 DeVry moved to Chicago, destined to be his permanent home, as a cameraman with the Rothacker Corp. Working in his spare time and with a capital of only $125, he produced in 1913 the first successful portable projector which could be carried in a suitcase. In 1914 he founded the DeVry Corp., which was subsequently purchased by the Q.R.S. player-piano roll company. In 1932 DeVry bought back the Q.R.S. outfit.

Primarily a Research Man

DeVry joined forces with Dr. Lee DeForest in the twenties to produce some of the earliest sound reproducing equipment. One of the products of this association was the DeForest Training School, which still is operating very successfully in Chicago. At his death DeVry had ready for the market a new projector with many unique features which attest to his fine mechanical attainments.

Primarily a research man, DeVry would no sooner produce a new model of a device than he turned to the development of another product, with practically every available penny of current sales being pumped back into development work. He loved motion picture work no less than he extended unwavering loyalty to the workers in the art, and to both he gave in great measure his utter sincerity, support and affection. —J. J. F.

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Much has been written and many complaints made about flimsily-constructed theatres and the headaches they bring projectionists, not to mention servicemen.

A theatre in the Midwest was having trouble with the sound cutting out anywhere from one-half to as much as four minutes and then coming back "on its own." This is typical of the transient type of trouble that is so hard to clear because it always rights itself before it can be traced to its source.

In this particular case the loss of sound was caused by an open circuit developing in the main volume control. The open circuit developed whenever the wall holding the potentiometer was jarred, which occurred every time a heavy truck went by the theatre.

This recalls a similar instance back in the old Vitaphone days wherein engineers came from far and near to a Mississippi theatre in an attempt to clear a particularly bad case of record-groove jumping. Two or three times a day the reproducer needle would jump several grooves, and no one could find out why until some bright boy tied it up with the traffic in the streets below.—L. W. CHANSKY, *ALTEC, Moline, Ill.*

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Here is a stunt that other service inspectors may find to come in handy. There is nothing unusual about it, but often it just doesn't occur to one. One of my theatres was giving a gala performance last New Year's Day. The house was packed and because of the greater sound absorption of the audience as well as the high audience noise level it was necessary to operate the system wide open.

Although it appeared quite possible that some trouble was present in the system (as I later determined) rather than interrupt the show even for a few seconds when a packed house was present, I tied my emergency amplifier into the system and with the increased power it provided, the special holiday show was put over with even greater power and impressiveness than if the regular theatre amplifier had been relied upon alone. — T. E. DEVORE, *ALTEC, Salt Lake City.*

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Every once in a while the trade periodicals publish humorous and ridiculous combinations of picture titles which sometimes occur on theatre marquee signs.

The same peculiar coincidents occur in shooting sound trouble. Several months ago I read an item where Steve Welsh answered a case of involved trouble and found the picture being presented was "Trailing Double Trouble" —which he had to do literally.

Last month I had a date at one of my theatres for a regular inspection, and. by coincident, happened to be present at the very time when a rectifier socket chose to short-circuit. I was able to clear it in double quick time. The theatre was playing the "Lone Wolf Keeps a Date."—F. J. PFEIFF, *ALTEC, Hamden, Conn.*

Large-Screen Theatre Television Data

Here is how television makes it possible for an audience at the New Yorker Theatre, on West 54th Street, to see a championship boxing match at the very moment it is being fought in Madison Square Garden:

First, the fight is shot at the Garden by a mobile television unit. Television cameras catch the light impulses and parabolic (long range) microphones catch the sound. Together these light and sound impulses are conveyed by telephone wire to NBC in Radio City. From there they are relayed to the New Yorker over a balanced telephone wire, a special wire for carrying television and sound signals.

At the theatre the signals are unmixed, the light impulses directed to the projector, and the sound impulses to loudspeakers by means of two control consoles in the balcony.

The sound system consists of 16 loudspeakers set up in different positions throughout the auditorium. The research staff devised the arrangement of the speakers so that the man at the control console can give direction to the sound. For instance, if the operator saw from the screen that the sound was coming from the right, he would bring the loudspeakers on the right into play. The audience is given a perfect illusion of three-dimension sound.

Television Projector Details

The projector, which looks like a steel drum, is located at the balcony edge. It is 34 inches in diameter and 34 inches long. Inside it is the Kinescope, a big television tube built to handle 60,000 to 70,000 volts which are supplied by a high-voltage transformer that stands near the projector. At the back of the barrel-shaped projector is a concave mirror 30 inches across. This reflector takes the televised images as they materialize on the face of the tube and casts them through a rectifying and magnifying lens to the screen, 60 feet away. When they reach the screen, the images are 15 by 20 feet.

Close-ups of the fight, made possible by telephoto lenses of the latest Television cameras developed by RCA Laboratories, afford the theatre audience a better view of the battle than many Garden spectators have.

The telephone wire from the Garden to Radio City and the telephone wire from there to the theatre is a miniature of the television networks RCA engineers predict will some day make theatre television available all over the United States. A television cable is already installed between New York and Philadelphia.

AVERAGE ADMISSION IS 24c.

An increase of fractionally more than a cent in the average admission price of American film theatres during 1940 off-set a drop of approximately 5,000,000 in weekly attendance to keep the total U. S. film theatre gross at the billion dollar mark.

Exclusive of taxes, Federal and state, in effect at the nation's box-offices, the average admission price now stands at 24 plus cents, according to the 1941 edition of The Film Daily Year Book of Motion Pictures, now being distributed.

Weekly attendance in 1940 averaged 80,000,000, it is estimated, as against 85,000,000 in 1939 and the all-time high of 110,000,000 recorded in 1930.

Altec Expands By Taking Over Lansing Assets

Expansion of the functions of Altec Service in the motion picture industry are revealed in the announcement by Altec President L. W. Conrow, of the formation of the Altec Lansing Corporation, and the acquisition of the assets of the Lansing Mfg. Co., of Los Angeles.

The new company, Conrow said, will carry on the manufacture of Lansing loud speaker systems for theatre use, as well as provide for the general distribution of public address equipment. Heading the new Altec Lansing Corporation is G. L. Carrington, vice president and general manager of Altec.

"The new company will provide the necessary facilities for broadening the distribution of Lansing loud speaker systems to a national basis," Conrow stated, "and to make more readily available a product for which an increased demand has already been created by the growing importance that Hollywood is placing on the box office value of improvements in sound reproduction."

Altec Lansing, Conrow stated, will continue to act as a supplier to the major equipment companies.

Projection Looms Large in Du Mont Tele Studio

With most of its equipment already installed and tested, the Du Mont television station W2XWV perched 650 feet above the sidewalks of New York, at 515 Madison Ave., is rapidly mobilizing its technical and program facilities for anticipated commercialized television. This station is equipped with a 4000-watt peak rating video transmitter, and a 1000-watt audio (2000-watt F.M.) transmitter for complete sight-and-sound broadcasting.

The studio facilities cover both direct and film pickup, not overlooking remote pickup as well. Direct pickup equipment will take care of close-ups and small studio groups, and is believed ample for present program technique and available material.

A fireproof room with several projectors will provide film pickup programs. Both 35 mm. and 16 mm. will be used, for the greatest variety of film subjects. The pictures are projected through loopholes in the fireproof wall, on to the image-dissecting tube of the television pickup equipment. This equipment, incidentally, is mounted on wheels riding on rails parallel to the fireproof wall, in order that the pickup can be brought in line with any projector. Thus the pickup covers the battery of projectors, and picks up one projector while another is being threaded or prepared for the continuation of the program.

Exhaustive tests made by Du Mont engineers indicate that the high-definition Du Mont system, permitting 625 lines or more within present television channel limitations, as against 441-line scanning heretofore featured in television broadcasting, will reproduce all the pictorial detail present in the average 35 mm. film.

Poll Shows Family Films Win Young and Old

Pictures dealing with wholesome family life polled the largest number of preferences in a survey conducted by the Better Films Council of Grand Rapids and Kent County, Michigan. Questionnaires were filled out by 342 adults and young people and by 635 boys and girls under 16 years of age, and in both classifications the family picture received the largest number of votes.

The children's questionnnaires showed that the family pictures such as the Hardy series received 129 votes, while its nearest competitor, the musical pictures, received 74 votes. Runners-up in their order of preference were westerns, travel and adventure; scientific, like "Edison the Man"; comedy, animal, horror, Shirley Temple, religious themes, historical, war and fighting, love scenes, cartoons and pictures featuring cruelty.

Suggestions for Improvement

Favorite types among the grown-ups in their order after family pictures were historical, travel, musical, comics, romance, mystery, religious, scientific, patriotic, crime, "super-colossals," war and horror.

Suggestions for improvement in motion picture entertainment were almost identical among the two groups. Both the adults and the children wanted more comedy, more historical pictures, less divorce, less murder and crime, less war, less tragedies, more musicals, fewer drinking scenes, less propaganda, more stories from popular literature, more pictures about citizenship and loyalty and *better theatre facilities.*

Control-Track Sound System to Feature S.M.P.E. Convention Program

PAPERS and demonstrations anent control-track sound recording and reproduction will feature the Society of Motion Picture Engineers' Convention to be held in Rochester, N. Y., May 5-8, the complete technical program for which already includes 48 papers in addition to the usual committee reports. A highlight of the meeting will be the joint sessions of the Society's delegates and those of the Acoustical Society of America.

The scheduling of the "Informal Report of Control Tracks and Multiple Horns" by the Research Council of the Academy of M. P. Arts & Sciences gives rise to hopes for early standardization of this new technique, inasmuch as no actual installation of such theatre equipment will be made until standards are set. Other phases of this topic will be dealt with by representatives of RCA Mfg. Co., Bell Telephone Laboratories, Paramount Pictures, Warner Brothers, and Walt Disney Studios.

Indicative of the wide diversity of the technical program for the meeting is the inclusion of many other papers on topics ranging from visual education to safety devices for the theatre projection room. Two papers will discuss improved optics, namely, "Some Properties of Polished Glass Surfaces," by F. Jones of Bausch & Lomb Optical Co., and "Improvements in Methods of Surface Treatment of Lenses," by W. Miller of Vard Mechanical Laboratories.

Many Projection Papers

As usual, theatre projection will be accorded a prominent place on the program. Some of the more interesting projection papers are: "Projection Room Requirements," by J. J. Sefing; "Factors Affecting Sound Quality," by A. Goodman, of RCA; "A Suggested Clarification of Carbon Arc Terminology," by H. G. McPherson, of National Carbon Co.; and "Factors to be Considered in Sound Screens," by G. F. Holly, of RCA.

Another contribution by National Carbon Co. engineers—"Improved Methods of Controlling Carbon Arc Position"—may signalize the introduction of a new and radically different method of arc control. This question has had the attention of several leading research laboratories over a period of years. Topping off the session will be the report of the Projection Practice Committee, which effort is invariably of high order.

The social side of the program will include the usual Ladies Committee, conducted tours to points of interest in and about the city of Rochester, one of the most beautiful in the United States, golfing privileges at local clubs, and finally the traditional banquet and dance, which this year will be held on the evening of the second day.

Abstracts of some of the papers scheduled for the meeting are appended hereto:

FIVE NEW MODELS OF 16-MM SOUND KODASCOPES

W. E. Merriman

Eastman Kodak Company

A new line of Eastman 16-mm sound projectors identified by the model numbers, *F*, *FB*, *FB-25*, *FS-10*, and *FB-40* will be described. The picture mechanisms and soundheads of all models are identical. The difference among the models lies in the finish, the carrying cases, the power output of the amplifier, and the speaker equipment. The first three models will operate on alternating or direct current; the last two are for 50-60 cycle duty.

Some of the standard features of these projectors are a 750-watt projection lamp and a 2-inch projection lens of $f/1.6$ aperture. There is a focus adjustment on the scanning optics to permit satisfactory reproduction from either reversed negative or positive contact prints. A carefully designed rotary stabilizer is common to all models. A rotary snap switch, which turns on the pilot light, motor, and projection lamp in the proper sequence, is also standard equipment.

AIR-CONDITIONING SAFETY DEVICE FOR THEATRES

E. R. Morin

Connecticut State Police

A new fire damper release and method of preventing smoke from being recirculated or pumped into a theatre auditorium through

(*Continued on page* 25)

300 MORE THEATRES PLAYED DOUBLE FEATURES IN '40

Double features, assailed repeatedly by public groups, critics and even a respectable segment of the film industry, scored gains rather than suffered reverses in 1940, according to the 1941 edition of *The Film Daily* Year Book of Motion Pictures, just published.

Whereas 10,031 operating U. S. film theatres followed a duals policy in 1939, in 1940 the total was 10,349, according to the Year Book's statistical review, covering seven pages.

Single-feature policy theatres also increased in 1940, but to a lesser extent. Total now stands at 7,192 as against 6,972 in 1939.

'ROBBIE' JANETTE SALES HEAD

Max L. Robinson has been appointed sales manager of the Janette Manufacturing Co., 556 West Monroe St., Chicago, Ill., makers of motors and motor generators. Robinson, whose sales experience in the electrical industry dates from 1915, will be remembered by his many projectionist friends as a former sales manager for Roth Brothers & Co., many of whose generators are in use in the projection field.

WANTS COPY OF 'S. P. CIRCUITS'

Mrs. Paul E. Spooner, 818 North Bristol, Santa Ana, Calif., is desirous of purchasing a copy complete with diagrams of "Sound Picture Circuits," which was published in 1936 by J. J. Finn Publishing Corp.

Drive-Ins Score Heavily in Number, Technique

EXTENT of the current and future scope of Drive-In theatre building is indicated by statistics disclosed recently by W. W. Smith, head of the licensing organization, Park-In Theatres, Inc., of Camden, N. J. Currently there are more than 50 such open-air film "houses" in operation, and some 60 new projects are planned by circuits and independents with completion expected within the next 24 months.

It is estimated that a minimum of $2,000,000 has already gone into the construction of Drive-Ins, which are spread through approximately half of the 48 States, and that another $2,000,000 represents investments set for the balance of 1941 and the following year.

Size of Drive-Ins now operating varies from 135-car to 800-car capacity, and the average is about 400 cars. For a 300-car theatre, six to seven acres of land are required; and 12 acres will accommodate 800 cars. Considerably over a mile of roadway is used for accommodation of cars within the average Drive-In today, and the average number of employes per present Drive-In is from 15 to 20.

Many Technical Advances

Admission prices range from 25 cents per person to a 35-cent top, with a number of such theatres asking 30 cents.

Check-up reveals that 60 x 50 screens are widely in use, with projection throw ranging from 200 to 250 feet; whereas at the outset of the outdoor boom screens were usually 40 x 30, employing a throw of about 135 feet.

Tremendous progress has been made, and is continuing, in the matter of carrying sound to patrons' automobiles. In the beginning, the large, single speaker was employed, then the "sound-in-ground" method was developed, followed by the RCA In-Car speaker. Currently, Motiograph has perfected its method of broadcasting directly to the car, with sound being issued via a small speaker within the car. This latter method, engineers say, holds vast potentialities and is expected to lend further impetus to the spread of Drive-In stands.

RCA Theatre Tele Show of Champ Boxing Match

A demonstration of large-screen theatre television will be held for leaders of the movie and radio trades at the New Yorker Theatre, New York City (54th Street, West of Broadway), Friday evening, May 9, it has been announced by Thomas F. Joyce, vice-president of RCA. Highlighting the special program of events to be projected on the 15 by 20 foot movie screen will be a showing of the middleweight championship boxing bout between Billy Soose and Ken Overlin, televised direct from Madison Square Garden. The remainder of the demonstration, originating from the NBC television studios in Radio City, will include a news broadcast, a dramatic playlet and a round-table discussion among prominent movie, radio and sports figures.

Dramatization of the championship bout on the television-movie screen will be made more vivid by the use of a special sound system involving multiple

RCA Photophone speakers throughout the theatre, enabling attending engineers to further contribute to the illusion of ringside attendance.

"In the presentation of large-screen television," Mr. Joyce declared, "promoters see the possibility of ringside seats at championship boxing bouts through television theatres in key cities throughout the United States. They visualize 1,000,000 people seeing a Joe Louis fight held in New York or Chicago. Of an even larger number of people witnessing a future World Series."

BART GREENE IN 25-30 CLUB

Bart Greene, Chief Inspector, Department of Water Supply, Gas and Electricity, New York City, who has been connected with the Department for thirty years, was made an honorary member of the 25-30 Club, Motion Picture Projectionists of Greater New York, at a recent meeting.

'PORTABLE' THEATRES TOTAL 2% OF ALL U. S. FILM HOUSES

Better than two per cent of the theatres in the U. S. are so-called "portable" houses, it is revealed in a survey of a complete list of theatres in the 1941 *Film Daily* Year Book. Checkup showed 463 situations using portable equipment in darkened theatres, town halls, and other rented properties usually operated in circuits. Figure is thought to be conservative, as it is probable that not all of the portable houses were so indicated when the list was compiled.

Almost half of the portable theatres are listed in 10 Midwestern states with 222 situations recorded as follows: Minnesota, 9; Wisconsin, 25; Michigan, 14; Illinois, 10; Iowa, 66; Missouri, 60; North Dakota, 3; South Dakota, 7; Nebraska, 3, and Kansas 25.

Seven Rocky Mountain region states are listed with 82 temporary equipment houses: Montana, 3; Idaho, 27; Wyoming, 2; Utah, 36; Colorado, 9; New Mexico, 1, and Nevada, 4.

Third Largest Group in South

Third largest grouping is in eight Southern states totaling 79 theatres: West Virginia, 11; Tennessee, 10; South Carolina, 1; Georgia, 7; Alabama, 22; Florida, 5; Arkansas, 18, and Mississippi, 5.

Survey showed 55 houses in the three Pacific Coast states as follows: Washington, 30; Oregon, 18, and California, 7.

New Power Resistor Decade Box Introduced By Clarostat

Introduced several months ago, the Clarostat power resistor decade box easily solves practical resistance problems under actual working conditions. This instrument is something radically new in resistance decade boxes. Instead of a mere measurement or resistance value, it actually provides a precise power resistor of anywhere from 1 ohm to 999,000 ohms, for actual use in a given circuit. It provides a *power resistor* handling up to 225 watts per decade. Merely adjusting any or all of the six rotary decade switches provides any resistance value within the enormous range. The reading for the inserted resistance is read from the decade dials, duly observing the multiplying factors indicated.

Power resistor decade box

The power resistor decade box does away with time-consuming and usually uncertain resistance calculations. Much time is saved in deciding upon the best resistance value to use, by actual practice. The instrument is especially valuable in determining parallel resistance values, in voltage-dropping requirements, and for other practical functions. Instead of having a large collection of power resistors on hand, or waiting days to obtain different units, this one instrument instantly provides any required value, known or unknown, for a circuit. Full particulars from Clarostat Mfg. Co., Inc., 285-7 North Sixth Street, Brooklyn, N. Y.

NAT GOLDEN'S NEW DEPARTMENT

Nat D. Golden has been appointed industrial consultant to handle the entire amusement industry with the Dept. of Commerce following the abolishment of the Motion Picture Division of the department, which he formerly headed, as a separate entity. The new Amusement Section will be included in a newly-formed Industrial Economics Division. Golden's new section will continue to exercise keen interest in film matters, it is expected, since a recent Cen-

sus Bureau survey showed that films accounted for two-thirds of every amusement dollar spent in the U. S.

Golden is a member of I. A. projectionists Local 160 of Cleveland, and has addressed two national I. A. Conventions.

G. T. E.'S '40 EARNINGS TOP '39; TAX PAYMENTS SOAR

Consolidated net profit of General Theatres Equipment Corp. for 1940, after all charges including Federal income and excess profits taxes, amounted to $849,820, compared with $696,062 for 1939, according to the company's annual report. The 1940 earnings, a gain of $153,758, were equivalent to $1.45 per share on 586,087 shares of capital stock outstanding at the year-end, compared with $1.17 per share earned on 592,887 shares in the preceding year.

Provision for Federal income and excess profits taxes for 1940 amounted to $259,300, compared with $104,600 provided in 1939.

After dividend payments aggregating $499,454, the net addition from operations to consolidated earned surplus was $350,365, making a total of $1,075,268 added to consolidated earned surplus since the inception of the corporation in 1936. During the year 6,800 shares of capital stock of the corporation were acquired in the open market and retired at a cost of approximately $8.74 per share, which was charged to paid-in surplus.

President Earle G. Hines in his letter to stockholders stated that the 1941 outlook is for a "somewhat better than normal business" in sale of theatre equipment and supplies.

ABSTRACTS OF PAPERS GIVEN AT S.M.P.E. MEETING

(*Continued from page* 22)

the air-conditioning system in the absence of heat or flame has just been developed by the Motion Picture Division of the Connecticut State Police, and will be described in the paper.

ALL-PURPOSE SOUND-TRACK PRINTER

G. M. Best

Warner Brothers-First National Studios

When Warner Bros. Studio changed the type of recording from variable-density to ultraviolet variable-area several years ago, existing printers were unable to handle more than one type of printing on a production basis. Hence, certain printers had to be set aside for variable-density printing only, to take care of the sound-effects library; others for ultraviolet printing only; and one was segregated for white-light and blue-light printing of fine-grain duplicating negatives and positives.

As all these printers were from twelve to seventeen years old, they were not capable of producing prints completely free from weave or slippage; so under the supervision of A. J. Tondreau, head of the camera and laboratory repair shop at the Studio, a completely new printer was designed and built to handle all sound-track printing, both for the studio and release printing.

Incorporated in one printing head is a novel, non-slip film movement, a selection of filters for ultraviolet or fine-grain negative printing at the turning of a dial, accurate regulation of light over a scale nearly three times as broad as previous printers, and equipment for variable-density printing. Negative and positive weave is limited to ± 0.001 inch, the negative setting being adjustable to take care of negative shrinkage.

Operating at nearly twice the speed of previous printers, four of the new machines provide adequate service with ten companies shooting and three or more pictures in the dubbing and release stages.

SOME PROPERTIES OF POLISHED GLASS SURFACES

F. Jones

Bausch & Lomb Optical Co.

A discussion of work done at Mellon Institute as the Bausch & Lomb Fellow on the investigation of the durability of polished glass surfaces exposed to ordinary atmospheric attack; efforts to perfect accelerated tests so as to permit rapid determination of the durability characteristics of different kinds of glass; the application of this phenomenon to increasing light transmission; and to the artificial stabilization of surfaces on glass normally not very durable.

IMPROVEMENTS IN METHODS OF SURFACE TREATMENT OF LENSES

W. C. Miller

Vard Mechanical Laboratories

As early as 1892 it was known that the reflectivity of polished glass surfaces was reduced and the light transmission increased when a suitable thin film was present on the surface of the glass. Many efforts to produce such a thin film artificially met with only partial success.

In the last five years two different methods were discovered which achieved the de-

sired results. Only one of the processes, however, was satisfactory for commercial application. Great improvements have been made in the durability and weather resistance of the thin films deposited on the lens surfaces by this process.

Lenses coated with these improved methods require no more careful handling than any good lens is entitled to, and fingerprints and dust can be removed without detrimental effects to the coating. The thin films can not be scratched with anything less hard than a metal point.

By this process reflectivity can be reduced from 5 per cent for untreated polished surfaces to as low as 0.5 per cent for treated ones. Experiments show that even greater reductions are possible and should be available in the near future.

NEW AND OLD ASPECTS OF THE ORIGINS OF 96-CYCLE DISTORTION

J. O. Baker *and* **R. O. Drew**

RCA Manufacturing Co.

The work of previous investigations is reviewed and correlated with the results obtained in a comprehensive study of 96-cycle distortion due to the presence of sprocket-holes adjacent to the sound-track. This distortion has been known for some time. Much improvement has been made by the adoption of the magnetic-drive recorder, the non-slip printer, and the rotary stabilizer sound-head for the purpose of overcoming the problem of slippage.

Recording of sound on doubly-perforated film will introduce 96-cycle disturbances of both amplitude and frequency modulation because of the film flexure and possible variations of film speed at the sprocket-hole rate. Processing of sound records on doubly-perforated film will introduce a 96-cycle hum and amplitude modulation depending upon the processing technic.

Printing of sound records on doubly-perforated film introduces 96-cycle hum and disturbances of both amplitude and frequency modulation, due to film flexure and variations of film speed at sprocket-hole rate. Reproducing of sound records on doubly-perforated film introduces 96-cycle disturbances because of film flexure.

The use of doubly-perforated film for any one of the four steps of recording, printing, processing, or reproducing will result in a 96-cycle disturbance of the reproduced sound.

Since it has been proved that the presence of the sprocket-holes adjacent to the sound-track is the source of all 96-cycle distortion, and the omission of the sprocket holes entirely eliminates this distortion, it becomes obvious that singly-perforated film should be used throughout all phases of sound recording and reproduction if complete freedom from 96-cycle distortion is to be obtained.

A substantial improvement can be realized if the singly-perforated film is employed only for the original negative, master positive, and re-recorded negative, and doubly-perforated film for the release prints.

The use of singly-perforated film throughout all phases has a decided advantage of providing additional space, without affecting the picture dimensions for a double-width sound-track or two sound-tracks, one for control or other purposes.

SOME EQUIPMENT PROBLEMS OF THE DIRECT 16-MM PRODUCER

Lloyd Thompson

The Calvin Co.

The increased use of direct 16-mm production for industrial and educational use has caused a need for more and better equipment. A great deal of the 16-mm equipment on the open market has been designed for amateur use. Most of this equipment gives perfectly satisfactory service even when used for industrial purposes. However, much of it could be redesigned and built better so that it would stand up under hard use and would also allow the user to work faster and easier.

A limited survey was made among the 16-mm film producers to find what was most wanted in 16-mm equipment and film. Some suggestions are made for improvements in film stocks, cameras, and sound-recording and projection equipment. Improvements are also suggested for 16-mm laboratory service.

SOME RECENT ADVANCES IN THE PHOTOGRAPHIC PROCESS

C. E. K. Mees

Eastman Kodak Company

A popular discussion of recent advances in our knowledge of what happens when photographic materials are exposed and developed.

THE STEREOPHONIC SOUND-FILM SYSTEM: GENERAL PRINCIPLES

Harry Fletcher *and* **E. C. Wente**

Bell Telephone Laboratories

The general requirements are discussed for an ideal recording-reproducing system as determined by the characteristics of hearing of a typical group of persons listening in a typical concert hall or theatre. Quantitative values are set down as ideal objec-

tives. Although microphones, loud speakers, and amplifiers which had been developed for the stereophonic transmission system were available for meeting these objectives, no recording medium was known which would record the wide dynamic range of intensity levels which the objectives indicated was necessary.

However, this wide intensity range objective was met by using a compandor in the electrical system. A general discussion is given of the reasons for choosing the particular compandor used, for using variable-area rather than variable-density on the recorded film, for using three instead of a greater or lesser number of channels.

A general description of the stereophonic sound-film system is given, including the enhancement feature. This feature makes it possible to re-record from the original recording, at the same time making any desirable changes in the dynamic range or frequency response in each of the three channels.

MECHANICAL AND OPTICAL EQUIPMENT FOR THE STEREOPHONIC SOUND-FILM SYSTEM

E. C. Wente, R. Biddulph, L. A. Elmer, *and* A. B. Anderson
Bell Telephone Laboratories

The same mechanism is employed for propelling the film in both recording and reproducing. To permit recording of the longer orchestral selections without interruption, the machines are designed to handle film in 2000-ft. lengths. Special features of the film-propulsion system for obtaining great uniformity of speed at the translation points are described.

The three signal and one control-channel currents are recorded by means of light-valves of identical construction. All four tracks are exposed while the film is passing over a free-running supporting roller, mounted on the same shaft with a new type of internally damped impedance roller.

In reproduction, each track is exposed through an objective of high aperture to light from an incandescent source. After passing through the film, the light from each track is carried by a glass rod to a photoelectric cell.

THE STEREOPHONIC SOUND-FILM SYSTEM: THEORY AND PERFORMANCE OF COMPANDOR SYSTEMS

Harvey Fletcher *and* W. B. Snow
Bell Telephone Laboratories

The general theory of compandor systems is developed and shows that the intensity level of a group of signals can be compressed and then expanded without distorting the signals. It indicates the conditions necessary for obtaining this result.

Various types of compandor systems applicable to single and multiple-channel systems, both with and without pilot control, are discussed. Particular emphasis is given to copper oxide-varistor types of compressors and expandors, and it is shown how they can be used with vacuum tube-type rectifiers to obtain very desirable characteristics.

An expandor has been produced having a remarkable property—it introduces a gain into the signal channel which is equal to the increase of the current in the pilot channel. This linear relationship holds through the wide-intensity range of about 50 db. In other words, if the electrical power in the pilot channel is increased tenfold, the signal leaving the expandor is in-

creased tenfold. The current in the pilot channel may be increased as much as 300 times and still the signal current going from the expandor will be increased by the same factor.

Methods have been devised for gradually balancing out from the signal channels any distortion effects coming from the pilot channels.

THE STEREOPHONIC SOUND-FILM SYSTEM: PRE- AND POST-EQUALIZATION OF COMPANDOR SYSTEMS

J. C. Steinberg

Bell Telephone Laboratories

In order best to fit the volume range of the program material into the volume range available in sound-film, it is generally advantageous to pre-equalize the program material before recording, and to compensate for the equalization by means of a complementary post-equalizer on reproduction. The type and amount of pre-equalization depends upon the properties of hearing and on the characteristics of the program material and the film noise.

This paper discusses the relations between these quantities for systems using compandors, where the film noise varies up and down in level as the compandor gains vary. Ideally, different types of pre-equalization are needed for different types of program material, and a compromise must be made if a single type is to be used. The considerations leading to the choice of the pre-equalization used in the stereophonic recording and reproducing system are discussed.

ELECTRICAL EQUIPMENT FOR THE STEREOPHONIC SOUND-FILM SYSTEM

W. B. Snow *and* A. R. Soffel

Bell Telephone Laboratories

An electrical system is described which permits the use of sound-film, with its limited signal-to-noise ratio, as a recording medium for wide-range stereophonic reproduction of symphonic music. Noise reduction is accomplished both by pre-equalization, rising to 18 db above 8000 cycles, and by automatic signal compression and expansion of 30 db.

To secure maximum supression of noise and freedom from distortion, a pilot-operated, flat-top compandor system was selected. In each channel low-level signals are recorded on a separate track with constant gain 30 db above normal, which places them above the film noise. Higher-level signals cause automatic gain reductions and are recorded at substantially full modulation. These signals vary the intensity of a pilot tone, which in turn controls the compressor gain.

There is a pilot frequency for each of the three channels, and the three are combined and recorded together on the fourth film-track. During reproduction they are separated by filters, and operate expandors which restore the signals to their original forms but reduce the noise to inaudible levels.

The compressor and expandor gains are made proportional to pilot level in db, and the expandor range over which this relation holds is 45 db. Therefore a 15-db variation

in average pilot level during reproduction causes a corresponding average level change, but no distortion. This is used to allow expansion of the original signal intensity range during recording or re-recording by simple gain controls in the pilot circuits.

The paper describes the apparatus and circuits developed to accomplish these results, and discusses the frequency, load, distortion, noise, and dynamic characteristics of both constant and variable-gain elements. Also included are considerations of microphone and speaker arrangement and equalization to secure high fidelity of reproduction.

A LIGHT-VALVE FOR THE STEREOPHONIC SOUND-FILM SYSTEM

E. C. Wente *and* R. Biddulph

Bell Telephone Laboratories

This paper describes a light-valve incorporating large electromagnetic damping and operating directly through the ribbon resonance region. Resonance response is only 5 db above low-frequency response and so permits easy equalization. A suitable equalizer provides uniform string displacement per unit driving voltage over the band 30-14,000 cycles with very nearly constant phase-shift per cycle. Problems of structure and size have furnished a mechanical design having several interesting features, among which are mechanical robustness, protection against dirt and moisture, built-in ribbon and optical adjustments, and an optical system integral with the valve structure, thus permitting rapid replacement of valves in the recording machine. This unit has proved a rugged, stable, light-modulator especially free from intermodulation products.

INTERNALLY DAMPED ROLLERS

E. C. Wente *and* A. H. Muller

Bell Telephone Laboratories

Special damping rollers, capable of damping oscillations of rotating shafts without adding a steady load, were first devised by Prof. H. A. Rowland. These rollers had either an annular channel along the periphery filled with a liquid, or a wheel mounted loosely on a shaft co-axially fixed in an outer shell, the interspace being filled with a liquid.

The theory of the action of such rollers in reducing fluctuations in the speed of rotation caused by disturbances from either the load or the driving side is developed and the results are illustrated by graphs. A new form of roller is described in which liquid filling an annular channel within the shell of the roller is coupled to the shell by a mechanical resistance.

A NON-CINCHING FILM REWIND MACHINE

L. A. Elmer

Bell Telephone Laboratories

Cinching, or the sliding between layers of film within a reel, produces scratches and surface abrasions which increase the film noise level. Cinching is more likely to occur in rewinding than anywhere else in the normal usage of sound-film.

At the beginning of rewinding, when the supply reel is full and the take-up reel is empty, a small amount of torque is needed for rotating the take-up reel. Under this condition the film will be wound rather loosely.

When the supply reel is nearly empty, relatively high film tension is required to produce a given torque on the supply reel. The torque to be applied to the take-up

reel will then be high, on account of both the high film tension and the large radius arm of the film spiral on the reel. This high torque is almost certain to cause cinching in the loosely wound bottom portion of the reel.

The conditions to be satisfied, if cinching is to be avoided, are analyzed. A power-driven rewind is described which meets these requirements. The film tension is controlled by the weight of the film on the supply reel at all times during the rewind.

THE SUBJECTIVE SHARPNESS OF SIMULATED TELEVISION IMAGES

M. W. Baldwin, Jr.

Bell Telephone Laboratories

Small-size motion pictures, projected out of focus in simulation of the images reproduced by home television receivers, are used in a statistical study of the appreciation of sharpness. Sharpness, in the subjective sense, is found to increase more and more slowly as the physical resolution of the image is increased.

Images of present television grade are shown to be within a region of diminishing return with respect to resolution. Equality of horizontal and vertical resolutions is found to be a very uncritical requirement on the sharpness of an image, especially of a fairly sharp one.

DEVELOPMENT AND CURRENT USES OF THE ACOUSTIC ENVELOPE

H. Burris-Meyer

Stevens Institute of Technology

The acoustic envelope was developed in August of last year for Paul Robeson. Its purpose was to produce on the concert stage a zone in which acoustic conditions would approximate those of a small, highly reverberant studio. Such conditions were considered desirable since in them the artist hears himself easily and makes no unusual effort to project. The lack of such conditions, usually the case in the concert hall, may lead to tension and the technical faults incident thereto.

The technic consists in reproducing in the restricted zone the significant harmonics of the voice or instrument. The area within which the harmonics are audible must be limited since, for concert use, it is generally requisite that the audience hear nothing emanating from an electronic device.

The technic has been employed by Mr. Robeson in all his concerts this season, in halls of widely varying acoustic characteristics, accompanied by piano and by full symphony orchestra. It has also been employed experimentally with full orchestra and settings on the stage of the Metropolitan Opera House; for a violin soloist with piano accompaniment; and for choruses of over one hundred voices. It can be used without affecting radio pick-up.

NOTES ON THE MECHANISM OF DISK RECORDING AND PLAYBACK

O. Kornei

Brush Development Company

A theory is developed to explain the well-known amplitude losses, in particular of the upper frequency range, occurring in the transcription of lateral-cut sound recordings. These losses may be attributed to two different causes, one based upon the recording, and the other upon the playback process.

Certain general conclusions are derived with a particular view to proposed construction principles for pick-ups with reduced translation loss.

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APRIL 1941

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Monthly Chat

IT IS the smart theatre owner who moves right now to obtain whatever equipment he will be needing as far in advance as the next twelve months. Orders placed now may not be filled for quite some time, one manufacturer that we know of now being busy on a backlog of more than three months. Exhibitors apparently don't take seriously this threat of an equipment shortage, thus it is up to Mr. Projectionist to sound the alarm. Read all about it elsewhere herein.

• • •

The signal success scored by the new coated lenses in the projection field occasions wonderment that every theatre from the largest right down the line to the smallest does not avail itself of this vastly improved screen light. It isn't necessary to purchase new lenses to gain this advantage: your present lenses can be coated within a short time, during which you can either loan a pair of lenses or substitute an old, unused pair. What are you waiting for?

• • •

Conflicting statements anent an impending power shortage should not deter every theatre worker, and particularly the projectionist, from doing his bit for the national interest. In some Southern communities marquee light loads have been cut drastically and many other theatre lights have been either cut out or dimmed. Show business should voluntarily do its bit for the common good—before somebody else steps in and forces action.

• • •

We wish Hollywood Local 150 much luck in its drive to effect certain desirable changes in the Standard Release Print, but we doubt that the studios will be any more responsive to projectionist sentiment now than they have been for the past ten years.

• • •

The sharp division of industry sentiment concerning the applicability of television to the film theatre program reminds us of the film mogul who in 1926 witnessed a 30-minute demonstration of "talking pictures" in his private projection room. When the program ended and the lights came up, Mr. Mogul jumped to his feet and, gesticulating wildly, spouted to his associates: "See! I told you it couldn't be done!"

• • •

Believers in the utility of the mercury vapor lamp for film projection purposes have filed emphatic dissent from our recent editorial the burden of which was that this unit still was far from ready for this job. The sum of the dissents is that we'll see, and soon. O. K., then, we'll see.

• • •

The report of the meeting of the N. Y. State Association of Projectionists herein should prove of great significance to every member of the organized craft.

INTERNATIONAL PROJECTIONIST

VOLUME XVI APRIL 1941 NUMBER 4

More Data on Control-Track Sound

By *AARON NADELL*

THE only reason they haven't torn your sound equiment apart and put it back together all different is that Hollywood hasn't yet made up its mind anent the standards for reassembling it. Standards are necessary if all theatres are to be able to run the product of all studios. The new sound will be three-dimensional.

Back of the new developments are certain investigations in psychology. Change in the volume of sound or in the direction from which it comes, can and does produce strong emotional responses which are measurable in terms of blood pressure, breathing rate and body electricity. Investigations along those lines have been reported by Stevens Institute of Technology.

More directly connected with theatre operations, Western Electric, in April, 1940, demonstrated a "stereophonic" sound system at Carnegie Hall. Meanwhile, RCA engineers working with technicians of the Disney studio were developing what they called "Fantasound," perhaps because it was being used for Disney's picture, *Fantasia.* This system was brought to the public in November, 1940, and is currently being road-showed. The film cannot be sent to any theatre because special apparatus is needed to reproduce it.

Around the turn of the year Warner Brothers brought out their "Vitasound." Today, and for some months past, the Research Council of the Academy of M. P. Arts & Sciences is working to get the boys together. As soon as common standards and specifications are agreed upon they'll be around to tear your projection room apart.

A Double Improvement

Important to remember about the forthcoming development is the fact that it is not one improvement but two. Failure to grasp this point will lead to confusion. One of the improvements relates simply to volume. The range of volume that can be recorded on today's tracks is about 25 db. If sound is recorded below a certain level, it runs into background noise; above a certain level overloading and distortion are encountered.

The volume limitations of the sound track can be counteracted by means of a cue sheet calling for resetting of the projection room volume control at different points in the picture. Assuming that the range of amplification in the projection room were 50 db, a total range of 75 db could be obtained if the projectionist always followed the cue sheet. The method is naturally crude, and not subject to delicate *instantaneous* variations which a conductor or director would desire if he could get them.

The new systems substitute automatic volume control in place of the cue sheet. This is about how it works out: What it does is to "lift 'em out of their seats" when the volume jumps instantaneously some 60 or 70 db. Further, the result is a more natural reproduction of the volume range of a living orchestra and of naturally occurring sounds.

In the second place, and also by automatic control, the new systems shift the source of sound from one set of speakers to another. Some speakers are located in the body of the auditorium (Fig. 1). Backscreen speakers are increased to several banks placed side by side. In consequence the sound source appears to shift across the screen with the action. Off-screen sounds appear actually to come from the wings.

Volume Expansion

The amplification of a vacuum tube is governed in part by its grid voltage. Change that voltage and the amplification will increase or diminish. Voltage can be obtained by utilizing the voltage drop of current flowing through a resistor. If the current changes, the voltage drop will change proportionately. If such a resistor is connected with one end to the grid of a tube and the other end to cathode, a source of variable grid voltage will have been provided.

The amplification of a theatre system can thus be controlled by providing a current of variable strength. Such a

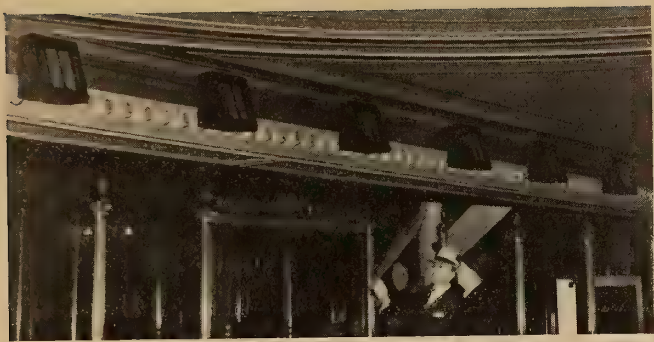


FIGURE 1

Some speakers are located in the body of the auditorium.

current can be obtained by amplifying and then rectifying the output of a photo-electric cell.

The simplest of the new systems publicly described to date is the Warner Vitasound (Fig. 2). Disregard for the time being the typewritten information there given, but note the appearance of the film between the sprocket holes. At the bottom of the illustration this portion of the celluloid is entirely opaque.

In the Warner system a sound photocell is mounted in the sound head, excited by a separate exciting lamp. This is the control pickup, entirely disconnected from the sound pickup, and wired to a separate control amplifier. In the case of a stretch of film represented by the bottom of Fig. 2 (with space between sprocket holes opaque) a 96-cycle current is drawn from the control amplifier, by reason of sprocket hole modulation of the control exciting light. This current is rectified and then applied to vary the grid voltage of one of the sound amplifier tubes, as explained previously.

When the top of the film of Fig. 1 passes through the control light, a 96-cycle current is also produced in the control amplifier, but it is of less intensity. Contrast between clear sprocket hole and clear celluloid is not as great as the contrast between clear sprocket hole and opaque celluloid at the bottom of Fig. 2. Hence, the 96-cycle alternations are weaker. At intermediate conditions of opacity intermediate strengths of 96-cycle current are obtained. And the strength of this current, as amplified and rectified, is what determines the automatic volume control grid voltage applied to the sound amplifier.

The sprocket hole control track shown in Fig. 2 could be used with any ordinary system to provide automatic volume control. All that would be necessary would be to re-wire one of the tubes in the existing system for variable grid voltage.

In the Vitasound system, however, additional full-size banks of low- and high-frequency speakers are added backscreen, and an additional amplifier channel is added in the projection room. Thus, a complete installation consists of two more banks of speakers, one additional amplifying channel, modification of the sound heads by addition of control exciter lamps and control photocells, and installation of the 96-cycle control amplifier and its associated rectifier. Further, both sound amplifying channels have one tube wired for automatic volume control.

In this system, one of the two amplifying channels drives the central bank of speakers, practically in the normal way. The other channel supplies sound current to *both* banks of side speakers. Normally the central speakers operate as usual, and the side speakers are silent. This condition continues while the control track is transparent as at the top of Fig. 1.

When the control track becomes increasingly opaque, as toward the bottom of that figure, the 96-cycle control current increases in intensity, changing grid bias in the sound channels to produce more amplification. The channel controlling the side speakers is set to respond first. As opacity of the track increases further the side speakers reach the same volume as the central speakers. From then on the amplification of the other channel also rises, and as the track grows still more opaque (bottom of Fig. 2), all three sets of speakers play at maximum volume.

It will be seen that this system is largely one of volume expansion, with an additional amplifying channel and additional speakers to handle extreme peaks that would overload a single-channel system. The three-dimensional effect is very small. As volume rises,

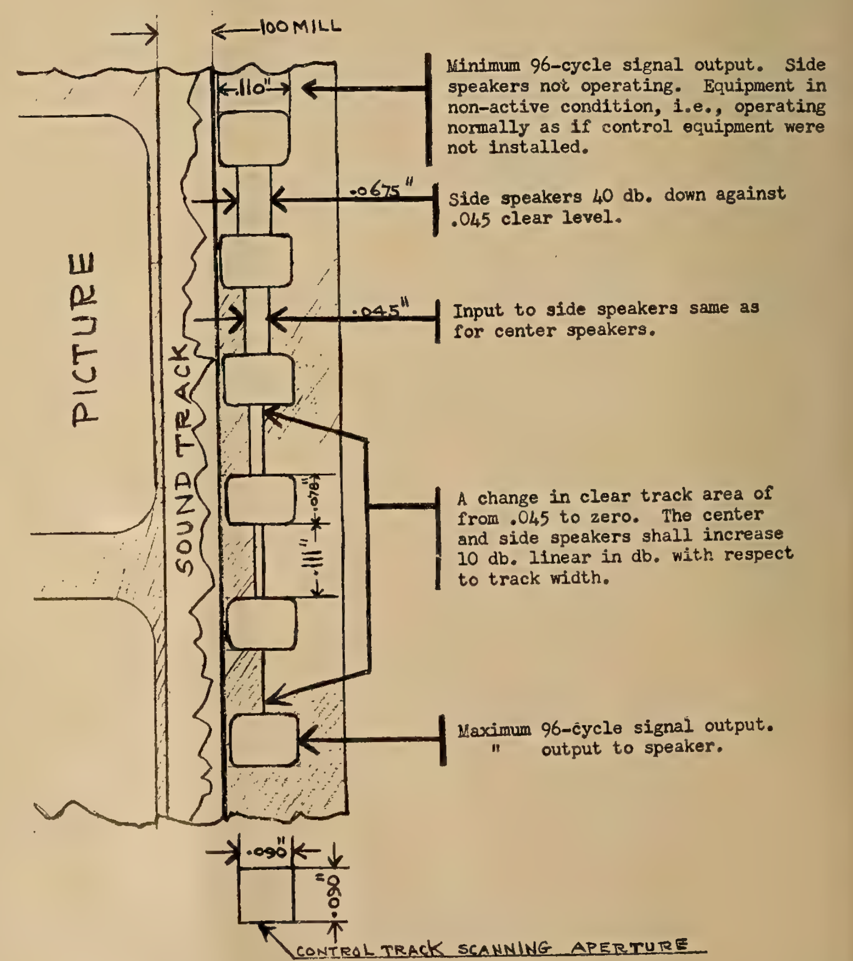


FIGURE 2. ***Detail of the Warner Vitasound system.***

the sound source spreads across the entire width of the screen; as volume drops, the sound source contracts to the center of the screen.

Three-Dimensional Sound

In contrast to the system just described, the Fantasound installation is the most elaborate and complex of those so far publicly described. Its complexity is the reason why the picture *Fantasia* cannot be distributed in the usual way, but must be road-showed. An enormous amount of new apparatus has to be added to the theatre.

The Fantasound system uses two films for each reel. One of these is an ordinary print carrying an ordinary soundtrack (for emergencies). The second is a 35-mm standard film having no pictures, but four separate, push-pull tracks across the whole of its width; just those four tracks and nothing else.

Three of these push-pull tracks are three different recordings of the sound, supposedly representing right, center and left microphones, respectively. Actually, eight microphones were used in the making of the picture, and their results mixed or faded together by the conductor and director to produce three master tracks. These tracks don't all carry the same sound. In an orchestral recording, for example, the left track may carry the sound of the string end of the orchestra, while the right track carries the sound of the percussion end, and the center track a mixture of both. Played through three separate amplifiers and three separate sets of stage speakers, these tracks accurately reproduce the special distribution of a real orchestra.

The Fantasound installation begins with two additional sound heads—existing heads are not modified—each of these heads being mounted on its own pedestal and driven by its own motor. Its motor, however, is electrically interlocked with one of the projector motors to assure permanent synchronism. The sound film for a given reel is threaded up just as the picture film is threaded up, and the two started together. The special soundhead contains four push-pull photocells, one for each of its push-pull tracks.

Each of the three sound tracks on the special film thus plays through its own independent photocell, thence through its own amplifying channel and its own set of low- and high-frequency screen speakers.

The fourth track of the Fantasound sound film is the control track. It is not like the Warner control track. It resembles an ordinary push-pull sound track, but it carries only three frequencies and no more. Each of these frequencies varies in volume independently of the other two. Compare this with an ordinary sound track in which a trio sings three different notes simultaneously, each at a different volume.

The output drawn from the Fantasound control photo-cell is thus a mixture of three frequencies, each of which may have any volume. This mixture is amplified, and then the three frequencies are separated by means of frequency filters. The principle is exactly the same as in the networks used for modern low- and high-frequency speaker systems. The separated frequencies, now three independent alternating currents, are each separately amplified further, rectified, and each applied as a grid control voltage to one of the three sound amplifying channels.

The Fantasound system therefore requires the addition of two complete amplifying channels and two complete stage speakers assemblies, two sound heads on their own pedestals with their own motors, an electric interlock for the sound and projector motors, and control track amplifiers, filters and rectifiers.

Additionally, small speakers are located about the body of the auditorium, those at opposite sides of the house being poled or phased 180° (this is done merely by reversing wires to one of the two side sets of speakers) in order to minimize acoustic troubles. In other words, the small house speakers are wired as two groups. By manual switching, on cue, these banks of house speakers are substituted for the left and right screen speaker assemblies.

What the System Does

To begin with, the Fantasound system, being equal to three ordinary systems and being fully equipped with automatic volume expansion, gives a volume range of fully 65 db. In the New York *Fantasia* installation the maximum output is 320 watts, and the earthquake in *Fantasia sounds like an earthquake*. Next, three separate and different sounds can issue simultaneously from the three sets of screen speakers (which, of course, is impossible with the Vitasound system, where all speakers play the same thing though sometimes at different volumes).

Thus, not only can an orchestra be naturally reproduced in its special dimensions, but a sound can be introduced at, say, the left speaker group, fade there and simultaneously rise in the center group, fade there and grow in volume in the right-hand group. Thus the sound appears to move across the screen.

Fantasound System Details

By means of the auditorium speakers sound can be brought out into the body of the theatre. When this is done at low volume the audience cannot tell where the sound comes from: at loud volume, the audience finds itself sitting in the midst of the source of sound, which swells around it from every side. In both cases the emotional effect is profound.

Figure 3 is a block schematic of the

(*Continued at foot of next page*)

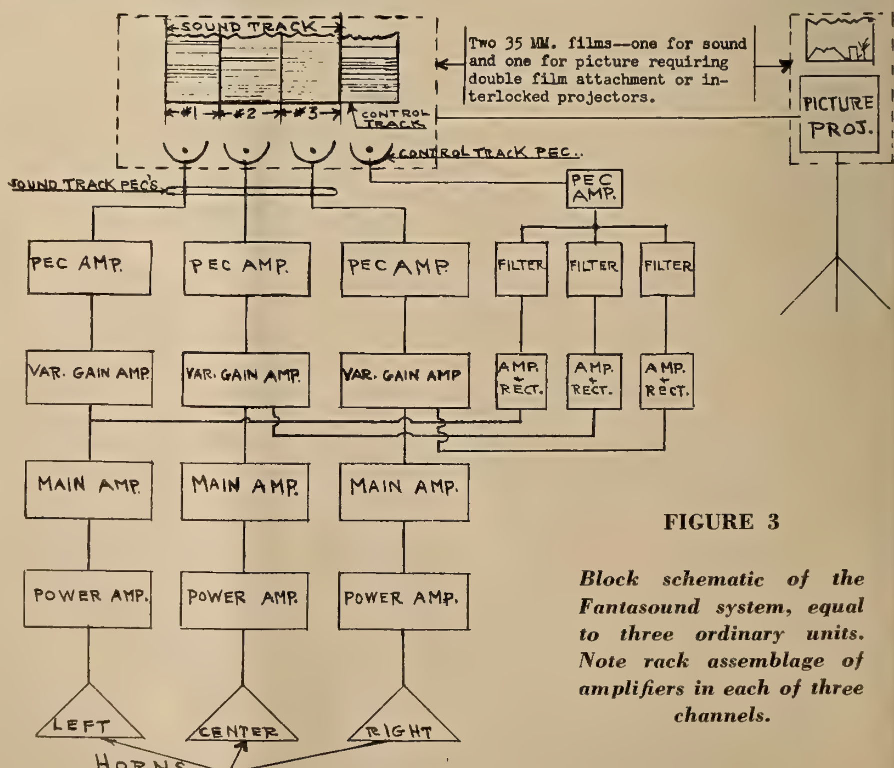


FIGURE 3

Block schematic of the Fantasound system, equal to three ordinary units. Note rack assemblage of amplifiers in each of three channels.

Television Gains on Home, Theatre Fronts

THINGS are definitely looking up for television following the green light turned on by the F. C. C. for commercialization of the art beginning July 1 on the basis of a minimum broadcast service of 15 hours weekly. While some television sponsors are talking of the existence of a "vast market" for home television sets to retail at about $200, the RCA group is advancing its plans for theatre television on a nation-wide scale.

Another development is the installation of a Scophony, Ltd., television apparatus in the Rialto Theatre, Times Square, New York City, the first of its kind in a regular film house. The Rialto management plans to sandwich in television broadcasts between its regular film shows, in addition, of course, to such special events of national interest as may be made available.

Despite the absence of any concerted sales drive on home receivers—if, in fact, any great number of home sets are ready at this time—it is reliably reported that at least a dozen national advertisers who are now spending large sums on radio are studying ways and means to present television shows. The big problem now seems to be getting the new medium started and then devising suitable program fare.

RCA has issued no information as to developments following its recent demonstration of a full two-hour program at the New Yorker Theatre before a select audience of motion picture people. This program included a direct broadcast of the Soose-Overton fight from Madison Square Garden to the theatre, where it was reproduced on a 15 x 20-foot screen.

From other reliable sources, however, comes word that no less than seven leading theatre circuits have expressed keen interest in theatre television and have made definite overtures to RCA for terms, *etc.* Fox West Coast is reputed to have asked for an exclusive deal for its territory on the basis of lease or outright purchase of the equipment. A theatre installation is figured to cost about $30,000 complete and ready to use.

Considerable interest attaches to the Rialto Theatre, New York, experiment with the Scophony equipment because it is expected that the program material will be comprised in the main of broadcasts by either CBS or RCA, with the British company not having announced any tieups with any sports group that could furnish attractions of special interest.

The consensus of opinion anent the RCA demonstration was that theatre television has three barriers to hurdle: 1, cost of equipment and maintenance, plus program charges; 2, the lack of suitable program material, and 3, improved technique in both pickup and reproduction. The latter criticism appears to be of lesser concern to film people, who would be expected to focus on cost and program material.

A few representative opinions of film people who witnessed the New Yorker Theatre demonstration are appended hereto:

ED KUYKENDALL, *president, MPTOA:* "Undoubtedly theatre television will come, but for the present I consider it a novelty that will quickly wear off because patrons still will be looking at pictures that talk. Further, $30,000 is a stiff price for a theatre to pay for equipment, particularly when that equipment must stand idle when no big event is available for televising."

MALCOLM KINGSBERG, *vice-president, KAO:* "RCA has licked the technical problems incident to theatre television, Refinement of technique, a reduction of costs, and the providing of suitable program material are the next steps along the road."

'Excellent,' Says Paramount Head

BARNEY BALABAN, president of Paramount: "An excellent program. I think theatre television will become a part of exhibition. This is not its final form, but it constitutes a good start. The development of programs with the sale of machinery and sets goes hand in hand."

E. C. GRAINGER, *president, Shea Theatres:* "Some time in the future television will come as an adjunct to film bills, but I can't see it as the principal feature in theatres. It will be good for spot shots of games and other events, but commercial possibilities are limited. It will cost plenty of money to televise important attractions, such as the stage version of *The Philadelphia Story*, and the circus. Based on the gross such attractions garner on the road, television producers would have to guarantee the grosses, which would be prohibitive for one television show."

MAX A. COHEN, *independent circuit operator of Metropolitan theatres:* "It was a very forward step, but what its application will be in terms of audience appreciation time will tell. At present I can't see making such an investment; I don't think theatres are ready for it yet. It will have to be vastly improved to offer theatre possibilities.

"From a practical audience viewpoint it lacks what audiences are accustomed to seeing in films. After all, you're asking the public to look at motion pictures or a substitute, and television must be 100 per cent competitive in entertainment quality to justify such an investment on my part."

FRANK CAHILL, *in charge of projection for the Warner circuit:* "Television has possibilities, but I don't think theatre people have anything to worry about. Television for regular theatre use is a long way off. Theatres may absorb such shows as an added attraction, but television commercially is not around the corner by a long shot because there are too many technical problems yet to be overcome. The commercial aspects have got to be developed before television can be sold for mass use."

C. E. BOYD, *chief film buyer, Warner Theatres:* "It's here to stay. What's more, theatre television, rather than hurt, will do us a lot of good. Whatever is good in the way of entertainment ultimately will benefit the theatres."

More Data on Control Track Sound Units

(*Continued from preceding page*)

system. Note that in each of the three channels the Variable Gain Amplifier, Main Amplifier and Power Amplifier are mounted in one rack assemblage, and constitute essentially a single channel. The usual low- and high-frequency loudspeaker networks are omitted from the drawing but are present in the apparatus. The control track equipment, three P.E.C. amplifiers, three filters and three amplifier-rectifier combinations, occupy their own rack and constitute one apparatus assemblage. The installation crowds the average projection room; some rooms aren't large enough to hold it.

While the Fantasound system gives amazing results, the trouble with it, as its designers will admit, is its great cost. Not to mention the fact that two reels of film must be distributed for each reel shown. Thus, the final answer, which the Research Council is now trying to provide, must be some combination of the results of Fantasound with the simplicity and low cost of Vitasound; in other words, a compromise.

One suggested compromise, not yet demonstrated publicly, utilizes a double sound track in the standard sound track location, and a control track in the sprocket hole region, but differing in principle from the Warner control track.

One suggestion offered is to do away entirely with the sprocket holes at the soundtrack edge of the film, using only the sprocket holes along the other edge. This arrangement will leave more space for sound tracks, it will certainly do away with sprocket hole noise, and some are convinced that more steady projection will be obtained.

The next development is up to the Research Council, which is working in collaboration with studio engineers and equipment manufacturers. Studios and manufacturers right now are crouched like so many sprinters waiting for the Council to give them the gun.

During recent years there have been many rumors, but little concrete information, regarding the experiments being carried out in Russia with stereoscopic cinematography. We are therefore glad to be able to publish this article by the inventor of a system apparently in use in Russia, describing the general principles of his system. While we regret that the author was not able to give more specific details of the optical system employed, and of the construction of his "perspective grille," we believe the present brief discussion of the subject will be of interest to all our readers. It is to be hoped that more complete details of the system may be available at a later date.—EDITOR.

RUSSIA'S Three-Dimensional Motion Pictures

By S. *IVANOV*

THE auditorium is plunged in darkness, except for a little lamp suspended from the ceiling by a long cord. But wait—an actor suddenly reaches out from the screen and draws the lamp toward him.

How did he do it? As a matter of fact, there was no lamp left burning in the auditorium. It was simply an effect produced by the stereoscopic cinema, which not only creates a tangible space behind the screen but apparently casts the image of the objects or persons in the film into the auditorium itself. Thus, the boundary-line between screen and audience mysteriously disappears.

A young man on the screen is smoking, and, strange to say, the smoke-rings float away over the heads of the audience . . . Now a little flock of gaily-colored birds sweeps out of the film and, circling about the auditorium, they surprise the people with their twittering. So real do they seem that one is half inclined to stretch out one's hand to catch one . . . A juggler flings a ball straight at the audience and those who happen to come within his line of vision blink and duck involuntarily to avoid getting it in the eye.

These are the kind of sensations one must expect to have at a showing of the first three-dimensional film in the first stereoscopic cinema-theatre, which was fitted up and ready to be opened in Moscow, on December, 1940.

Difficult Technical Problem

Right from the infancy of the cinema, inventors all over the world have been striving to bring sound, color and depth to the flat, grey, mute art of the film. The problem of sound was the first to be solved. Then came color. More and more color-films have been released during the last few years.

One of the most difficult of film problems proved to be stereoscopy, that is to say, the three-dimensional film. We were content with the silent screen until we discovered the sound-film. We admired grey monochrome until we could feast our eyes on color. And even now we do not really notice the flatness of the people, the houses, and the landscapes we are shown at the cinema. Yet the expressive power of pictures would gain immensely if the screen acquired the third dimension—depth, or bulk, if you prefer to call it that.

Leonardo da Vinci was one of the first to study the problem of stereoscopic imagery, and since his day countless attempts have been made to solve it.

Everyone, of course, has seen an ordinary, primitive "still picture" stereoscope. If we look at two views of the same object taken from different angles, we feel the space and relief in the photos. The main drawback of this simple apparatus is that it can be used by only one person at a time.

How can the principle of the stereoscope be applied in the cinema? Many of the methods suggested are based on the "spectacle" principle: that is to say, the audience can obtain the proper stereoscopic effect only if they wear special glasses. In this case the object can only be seen in relief by a very limited number of persons sitting directly opposite the screen. Instead of optic lenses some inventors suggest colored glasses (red and green) or "crossed" polarizing filters, but these do not produce the desired effect either.

We have succeeded in finding, after many years of experiment, what appears to be the most satisfactory solution of the creation of a stereoscopic film. Its merits are that it dispenses with the

necessity for wearing special glasses and that the representation in relief can be seen as such from any part of the auditorium.

The stereoscopic film differs from the ordinary in that each frame is divided into two parts, like stereoscopic photos, for the left and the right eyes. The filming of a picture can be done with an ordinary cine-camera, and does not require two objective lenses in the same camera.

A simple device called a stereo-nozzle, consisting of two mirrors connected by a hinge and placed at an angle somewhere approaching 180° to each other, is placed in front of the objective of the cine-camera. These two mirrors divide, as it were, the one image into two that are fixed on the film.

The stereo-film is also shown with an ordinary projector. The only difference is that the mirror arrangement that casts the reflection onto the screen is placed at the opening through which the ray of light conveying the image comes from the projection room.

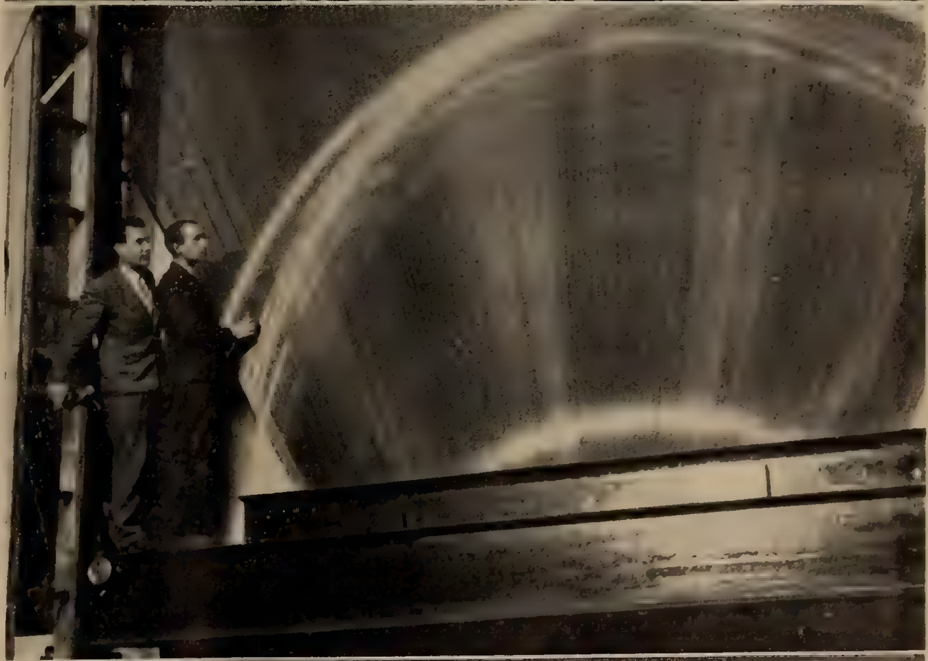
The principal thing is the screen. Ours does not resemble in the least the usual cinema-screens. A special grid made of radiating transparent and opaque bars is placed before the blank white sheet. Through this grid two images taken for the right and the left eyes are projected on the screen. The rays of light issuing from the one image are partly, on reaching the grid, swallowed up by its opaque bars, and partly pass between them and are projected on to the screen as narrow lines. The same thing happens with the rays from the other image, with this difference only—that its narrow bars, passing through the grid, are distributed among the lines of the first image cast on the screen.

Thus, the same screen shows the projection of two images arranged in the form of an opened fan, the spokes of which follow in strict alternation; that is, if the first spoke is an element of the image meant for the right eye, the second is for the left, the third for the right again, and so on.

The stereoscopic screen is formed of a metal framework weighing six tons. Over this thirty thousand copper wires of a total length of a hundred and fifty kilometres (about 93 miles) are drawn, forming a "perspective grille."

The wires are so fine and so close

(*Continued on page* 30)



Top: Camera with mirrors used in photographing stereo-films. Center: "perspective grille" in place before theatre-screen; Inventor Ivanov (in gray suit) at left. Bottom: close view of wires forming grille. On opposite page is reproduced a strip of stereo-film from "Land of Youth." Photos from Preslit.

Serviceman Status, 16mm. Competition Canvassed by N. Y. State Assoc.

SEVERAL problems which probably are of major concern to the organized projectionist craft throughout the country came in for extensive and intensive discussion at the recent semi-annual meeting of the New York State Association of Projectionists which was held in Rochester, N. Y., during the period of the S.M.P.E. convention in that city. The Association membership comprises representatives of every I. A. "O' and "M" local union in the State.

The inroads of 16 mm. production and exhibition on both cameramen's and projectionists' locals, and the matter of the serviceman's authority in "supervising" the projection room, in ordering replacement parts, and his status should he sever connections with his employer were the topics that occupied practically all the time consumed by the sessions.

Stating that the 16 mm. situation was particularly acute, Secretary Harry N. Brooks (L. 285, Troy) read several letters from N. Y. State locals which offered suggestions as to how best to combat this danger. The delegates were in complete agreement on the point that the use of 16 mm. film and equipment will continue its rapid rate of expansion, and that every I. A. member must lend himself to the fight against sub-standard film showings in theatres and in halls.

Re Competition—Meet It!

Delegates Whitford and Roe (L. 376, Syracuse) explained how they adjusted a condition that existed between the Local and a merchant who supplied 16 mm. pictures and equipment, and they added that wherever the Local encounters a competitive price, "it meets it"! Full cooperation was voted to cameramen's Local 644 in the matter of non-I.A. cameramen who might seek to work within any local's jurisdiction.

The real fireworks of the meeting were touched off by the introduction of the next question: "Should Sound Servicemen Have Full and Final Say on Ordering Replacement Parts for the Projection Room?" The ensuing discussion, in which a large majority of the delegates participated, included statements that such a condition tends to minimize the importance of the projectionist who is constantly in charge of the projection room and the equipment therein; that it places the projectionist in an inferior position with his employer, and that it results in a definite lack of cooperation between the front office and the projection staff.

Several delegates stressed the long-standing contention of the Association that if the managers would cooperate fully with the projection staff it would result in less expenditure of money, better maintenance of equipment, and a better show overall. The delegates voiced the opinion that the projectionist is a showman who has a definite responsibility to both his employer and the public, but that he objects to having that responsibility whittled away and his judgment ignored.

Militant Opposition Planned

There was much speculation as to the next move on the part of the service companies, but it was generally agreed that steps looking toward an application of the brakes to further usurpation of authority by the service companies should be taken at once. The unanimous opinion of the delegates was that the condition complained of should be eliminated forthwith.

An extension of the discussion anent servicemen and their status in the theatre field concerned the question as to whether the I. A. has ever ruled that a serviceman who is a member of an I. A. Local be allowed to service equipment in a theatre which is on the Unfair List and not be subject to having charges preferred against him. A motion was made and carried that this question be taken up with the I. A. General Office. [Ed.'s Note: *No evidence that I. A. ever so ruled exists*].

It developed that practically all the locals are without definite information as to the content of the contracts between the service companies and the theatres insofar as they concern projectionists. Approval was voted of a motion providing that in future a copy of all contracts, and renewals thereof, between service outfits and theatres be made available to the unions.

A request for information on point of what happens when a serviceman member of an I. A. Local loses his job evoked much discussion, but it was the consensus of opinion among the delegates that such a man would be eligible for a projectionist assignment.

Discussion of the desirability of having I. A. men service the new slot movie machines uncovered not a few difficulties in connection with such work, not the least of which is that it is practically a twenty-four hour tour of duty which would subject a serviceman to call at any time of the day or night.

Jurisdiction of Drive-Ins

The final topic of the agenda concerned the probability that new Drive-In theatres by the very nature of their location would induce numerous territorial jurisdictional conflicts between the various locals. Careful investigation prior to the submission of labor contracts was urged to avoid embarrassing a sister local. In addition, a committee was appointed to draw up a jurisdictional line covering all sections of the State.

Following the adjournment of the business session, Local 253 of Rochester played host to all Association delegates at the festive board, and in addition, enhanced its reputation for graciousness by extending invitations to all local managers and assistants, and to the projection people who were attending the S. M. P. E. convention then in session in the city. This move elicited much favorable comment among the engineers.—J. J. F.

Seattle is definitely double-feature territory from now on. Barclay W. Ardell, branch supervisor of Altec Service there, has become the proud father of twin boys.

Stereophonic Sound Scores

Delegates attending the N. Y. State Association of Projectionists meeting were able to attend the demonstration of Bell Telephone Laboratories stereophonic sound-film reproduction. These auditors, comprising in the main projectionists with many years of experience, were unanimous in classing the show as "marvelous" and representing a tremendous advance over current conventional systems.

The demonstration included a switch-over from reproduction by mechanical means to the use of live performers rendering the same music: and practically all the auditors were fooled when asked to state which medium of reproduction was used at a given time.

A Point of Information

Prize *mot* of the recent S. M. P. E. Convention came druring the projection session when a contributor thereto made several pointed references to the difficulty of delivering good projection when only one man is used on a shift.

One of the audience arose and, with feigned seriousness, inquired: "Could the author of the paper enlighten us as to whether there has been any serious consideration given to the possibility of operating projection room with less than one man?" When the full implication of this query became apparent the audience burst into prolonged laughter.

Who was the innocent lamb who posed the question? Why, it was P. A. McGuire, advertising manager of the International Projector Corp.

National Defense and its Effect Upon Projection Room Supplies

By *LEROY CHADBOURNE*

Even a casual reading of the accompanying article must drive home with compelling force the possibility of an acute shortage of necessary projection room equipment as a result of an accelerated national defense program. I. P. considers this one of the most important messages it has ever conveyed to the projectionist craft, and this, plus the well-known tendency of exhibitors to slight a theatre's equipment needs, would seem to indicate the urgent necessity for passing this information along to the theatre management.

NATIONAL defense needs will definitely conflict with the material requirements of the projection room. Important shortages in projection room supplies are seriously threatened. It is even possible that theatres in which no precautions are taken may have to close down, leaving their projectionists out of work.

For example, the latest published word from the Office of Production Management is that in 1942 there will be *no aluminum for civilian needs!* Electrolytic condensers, as all projectionists know, are made of aluminum, and depend on the chemical properties of aluminum for their capacitance. Suppose the supply source tells you in 1942: "Sorry, but we aren't allowed to manufacture replacements for civilian use." What'll you do, lock up the projection room and go home because a $2 condenser burnt out?

This sounds fantastic, ay? In 1919, not 1918, this writer was assistant purchasing agent for a typewriter factory, and that factory occasionally laid off hundreds of men for days, sometimes for weeks, at a time because it couldn't buy brass for this or aluminum for that. The writer's job then was to scour the United States by telegram and long distance telephone, humbly begging people to please sell us supplies so men could be kept at work. Naturally, that job didn't last: toward the end of '19 supplies grew plentiful again. But the country is again returning to the same state of affairs, for no one knows how long. In 1918 projection needed little more than carbons to keep going; today the projection room is a miniature factory needing all kinds of materials, and its standards of performance are infinitely higher.

Aluminum is only one material on the priorities lists which the projection room can't do without. There are other indispensables on the published priorities lists.

The projection room faces a triple threat:

1. Shortage of vital materials. Subsequently we will go over the important parts of projection room equipment and examine the materials involved.

2. Shortage of manufacturing facilities. Raw materials may be plentiful and still repair parts may be impossible to obtain because the factories are tied up with government work.

3. Shortage of electric power. In some communities this threatens voltage fluctuations too serious for normal projection room work to go on.

LENSES. All lenses except for eyeglasses are on the priorities lists; so are lamphouse reflecting mirrors. That is, makers will be allowed to supply lenses and mirrors to theatres *after* the government has all it wants for range-finders, bomb-sights and other military needs. In the meantime you may have to work with a cracked condenser, a pitted mirror, a projection lens in which the Canada balsam has let go—unless you put in some spares now while you still can get them.

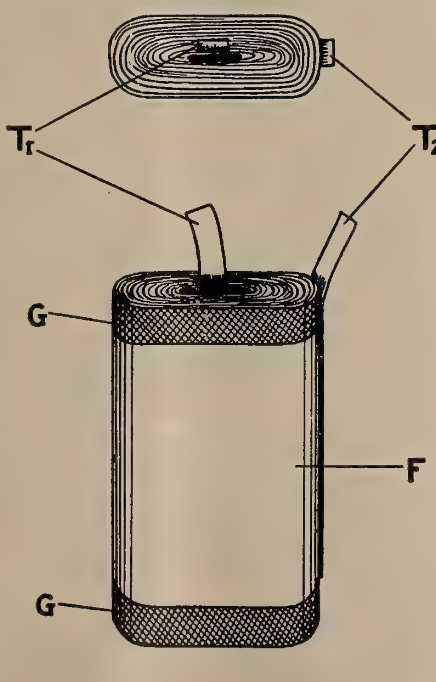


FIGURE 1
Electrolytic condenser construction: F, aluminum foil; G, insulation; T, T, tabs for external contact.

STEEL. Hardened steels are needed not only for military parts, gun barrels and so on, but also for machine tools. Similar steels are used, of course, for projector sprockets, cam, star, shafts and the like.

Hard steels are on the priorities lists, which means three things to the projectionist. If your projectors are likely to need factory overhaul in the next year or two, have them overhauled *now*. If you are likely to need *new* projectors in the next couple years, see if you can't get the boss to buy them *now*. And—stock spare parts now. You may not be able to get them when they are needed. Or you may get them after months of delay and then find them to be of inferior quality.

BRASS AND BRONZE. These on the priorities list. Any bronze gears in your projection room? Bronze or brass bearing sleeves on your motor—generator? Look your equipment over. Anything of bronze or brass that is subject to wear? Stock replacements now.

TUBES. These present a particularly complex problem, because so many different metals are used in their construction. For example, molybdenum. You've heard of it. Let's look in our little metallurgy book: "A very hard, silver-white metal . . . used chiefly in the manufacture of tool steel . . . rifle barrels . . . vacuum tubes." It is rare, semi-precious; the retail price in 1939 was $18.00 a pound. One reason among others why it is so important in the uses mentioned is the way it stands up under heat. Moly melts at 4,748° Fahrenheit as against 2,613 for iron and 1,990 for copper.

You'll be able to get tubes, alright. But the maker may not be able to put moly in them—not for you. Not for any one but the government. Because, if it gets to a choice whether your projection room runs with third-rate tubes or the army fights with third-rate rifle barrels—what do you think will be the answer? You'll work with third-rate tubes, and

they'll break down and burn out other things difficult to replace or repair.

The thing to do would seem to be to stock up on first-class tubes now while they're still easy to get.

Molybdenum is mentioned here merely as one example. Other metals used (according to the type of tube) include chromium, magnesium, mercury, nickel, tungsten and zinc—every one of which is on the priorities list! You'll get tubes in spite of that, but perhaps with all kinds of substitutions and makeshifts in their construction.

Condensers, Transformers, etc.

Condensers. The electrolytic type have already been mentioned, but it may be worthwhile to add that there is no substitute for the aluminum used in them. Magnesium could be made to do, but that's even scarcer. Experiments have been made with other metals. Something may be worked out. Why risk closing down? Before the writer lie specifications of a 40-microfarad electrolytic condenser which costs all of 38c, retail. Stock spares *now*.

The other type of condenser commonly used in theatre amplifiers is the "paper" condenser—treated paper forming the insulation between layers of metal foil. What metal? Well, aluminum, or tin foil. Both metals are on the priorities lists. Whether your condensers be paper or electrolytic, stock spares.

Transformers. New transformers are likely to become very scarce. The core generally is made of a special alloy. Steel makers study the magnetic properties of these alloys and submit curves to the transformer manufacturers, who design their transformers according to the magnetic nature of the alloy they decide to use. The steel people are busy now with more urgent things than special magnetic alloys for projection room transformers. Unless copper wire is put on the priorities list (a possibility, thought it hasn't happened yet) you will always be able to get a burnt-out transformer rewound, that is, new wire put on the old core. But that will take much longer than reaching for a new transformer off the shelf, and meanwhile your show won't run.

Even power transformers, which are moderately expensive, *should be stocked now*. You never had one burn out yet? You never yet worked with the kind of tubes you are likely to get, and the other amplifier parts you are likely to get, and the voltage fluctuations you are likely to witness.

Resistors. These are of two kinds, composition and wire-wound. It's a good idea to stock spares of the latter. Resistance wire again is a special alloy that the iron and steel people may be too busy to bother with, except of course for government needs. The composition types, as far as the writer knows, will be safe. They consist largely of varying quantities of carbon embedded in a semi-conducting cement. The variety of cementing materials that can be used in a pinch is rather large, and, of course, there are almost endless supplies of charcoal. These resistors are made by the millions; the requirements of the theatre market would scarcely dent the supply. Finally, if the exact resistor needed isn't available, two or more of different values can always be combined according to Ohm's Law to produce the same result.

Rectifying Stacks. If your rectifier is of the copper-oxide or the copper-sulphide type, you are safe unless copper is subjected to priority rulings. That has been discussed, but has not yet been done. It may never be done. Copper is indispensable for some war purposes. there is no substitute for it, but this country has a whale of a lot of it. But if your rectifier is of the magnesium type, stock spare units. Magnesium is on the list and will stay there.

Rubber. Not only rubber, but all rubber-like synthetics, are subject to priority. Your phonopickup may be rubber damped, or there may be rubber cushion mountings on your amplifier. A spare pick-up head, and spare rubber cushions if your amplifier uses them, should at least be considered.

Manufacturing Facilities

In addition to possible future troubles that may develop out of mere scarcity of material, you will need to guard against troubles arising only out of shortage of manufacturing facilities. The factories that make projection room supplies are also capable of making other things, and many of them are doing it. Don't ask your friend in the projector

(*Continued on page* 27)

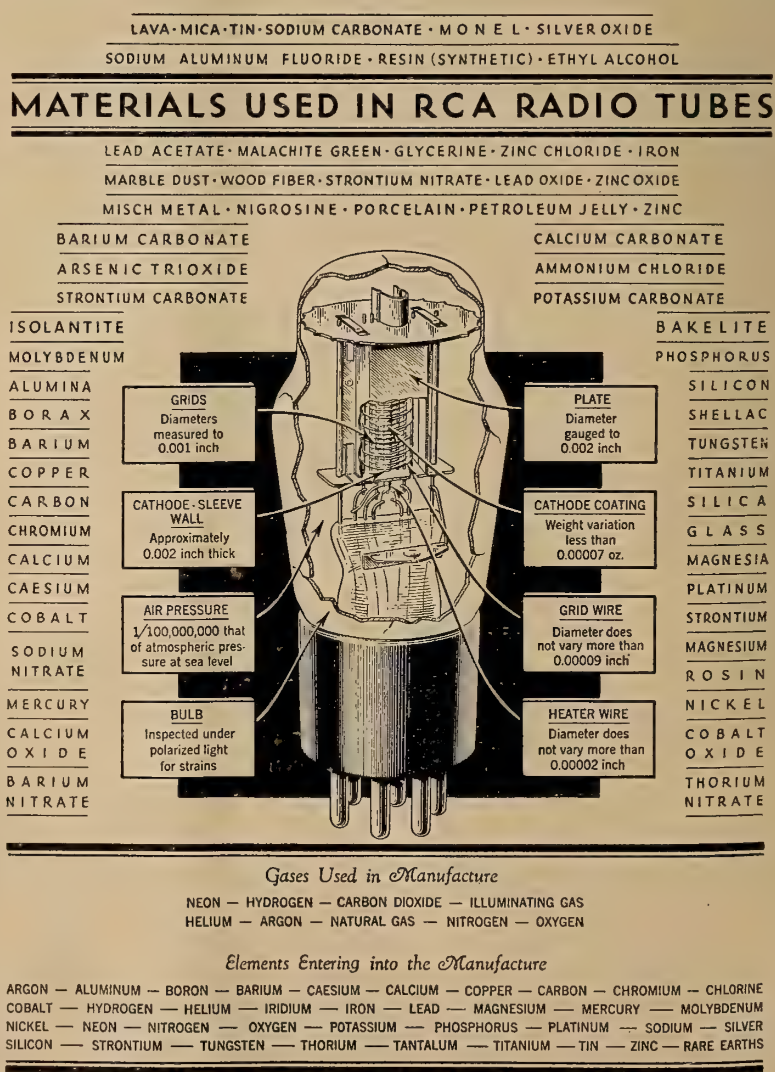


FIGURE 2. *A tube contains many vital defense materials.*

W. E. Novel Tube Film A Projectionist 'Must'

THIS is the story of a unique educational film that is so cleverly constructed and so highly informative on a most important phase of sound motion picture projection that it deserves to be seen by every projectionist. So simple is the procedure of obtaining this film that no projectionist organization can afford to render its members such a great disservice as not to obtain the film for showing before its members. Of this angle more anon; now let's get on to a description of the film.

Back of the intricate mechanism that is the sound motion picture reproducer is a family of performers carrying on highly important roles in filmdom's big show. Although generally unrecognized by the audience, projectionists and servicemen know these performers intimately, depend upon them constantly and quite frequently applaud them for their remarkable ability to work thousands of hours, year by year without a let-up. These veteran troupers are vacuum tubes—in this case Western Electric vacuum tubes.

A short time ago they rose to stardom in a motion picture called "A Modern Aladdin's Lamp." Assisting the stars is an excellent cast including Lowell Thomas, as actor and narrator; a group of Bell Laboratories egineers, making their first appearance on the screen; and an attractive ensemble of Western Electric Tube Shop artisans. Half way through the film a vigilant traffic cop halting an on-rush of electrons inside a tube, and a troupe of impish monkeys tossing pebbles at a grid, very nearly steal the show.

Tube Structure, Operation Given in Detail

Opening with Lowell Thomas seated before a microphone in a broadcasting station, "A Modern Aladdin's Lamp" traces the development of the vacuum tube from the first crude bulbs of Edison and DeForest to the efficient and powerful products of today's Bell Telephone Laboratories engineers.

The film shows how modern broadcasting and telephone repeater tubes are made, and pictures the many applications of the vacuum tube in everyday life. "From this product," says Mr. Thomas, "four great new industries have sprung—long distance telephony, radio, the modern phonograph, and sound motion pictures."

An interesting sequence explains the operation of the three-element tube so clearly by animation that even a lay-minded audience will understand. It is this sequence which brings to the screen the aforementioned traffic cop and the monkey troupe, the later vigorously hurling their pebbles as they impersonate the filament tossing millions of electrons through the vacuum.

Scenes photographed in the Western Electric Tube Shop depict the delicacy, the care, and the precision of workmanship that go into the making of these electronic bottles. The camera moves from one intricate operation to another while skilled craftsmen, using specially designed machines, transform coils of wire and varied shapes of glass bulbs into vacuum tubes.

"This magic lamp of today," says Mr. Thomas in the final sequence, "has created a million jobs—in every city and town and village in the country. Jobs in service and manufacture—jobs in entertainment and education. It has built a thousand factories—opened ten thousand stores and shops—created vast demands for the raw materials of farms and mines and forests. All these things happened because of a single

(*Continued at foot of neyt page*)

Down the panel: Western Electric engineers confer with cameraman before shooting 250-kilowatt vacuum tube. Animated sequences showing traffic cop halting on-rush of electrons and a lively troupe of monkeys tossing their pebbles at a grid.

Fatal Theatre Fires in Iowa Reveal Lack of Regulation

By *GEORGE HARTNETT, Secretary, I. A. Local 286, Des Moines*

Inquiry as to the cause of a recent theatre projection room fire in Radcliffe, Iowa, in which two lives were lost, elicited the response appended hereto. This contribution reveals the shocking state of affairs existing in that State with respect to proper building standards and competent, continuing supervision over theatres. Obviously, here is a situation that calls for concerted effort by the projection craft as a whole, not only in Iowa, to effect the speedy elimination of such conditions.

THE fire at Radcliffe is the third serious theatre fire in Iowa within the past two months. The first disastrous blaze was at Ottuma, where the theatre was razed. In May a theatre at Centre Point was completely destroyed by a fire which started when film caught fire in a projector. The projectionist evidently became panicky and wanted only to be rid of the burning film, for he tossed it out into the auditorium. Several persons were burned, luckily none seriously.

Anent the Radcliffe fire, the projectionist was rewinding a film when it suddenly, and mysteriously, burst into flames. Just what happened nobody will ever know, as the projectionist, and his wife who was waiting for him near the projection room, were burned to death. The building was completely destroyed. Fortunately, all the patrons had left the theatre when the fire started.

The Radcliffe theatre was operated by a company which has quite a circuit in the very small towns. None of these "theatres" have fireproof projection rooms; in fact, some have no projection rooms at all. Another circuit which operates in 105 small Iowa communities hardly knows what a projection booth is. Traveling from town to town, they simply set up a portable 35 mm. projector in the open and put on their shows.

The situation in Iowa in this respect is very grave. In the theatres in all Iowa small towns the "booths" are built of light wood, or cardboard, or compo board, or almost anything that is not fireproof. Only in our larger cities do we have fireproof projection rooms.

We have had introduced into the last four sessions of the Legislature a bill providing for fireproof booth construction—but we have never come even close to having it passed. All of the small towns, precisely where such protection is badly needed, send in a raft of protests against such legislation, arguing that such a law would deprive them of their entertainment.

Members of the Legislature do not take seriously the danger of film fires. The writer has been told time after time by legislators that he is greatly exaggerating these dangers and that they have never heard of any serious film fires. Statistics which tend to prove how erroneous is this view are met with blank stares and absolutely no action. I have protested that these legislators will one day be shocked out of their complacency by a horrible theatre fire which will claim many lives, many injured and maimed for life. The answer is always the same: nothing doing.

Our organization is a member of the National Fire Protection Association, and we have all their books and literature applicable to film fires and safety measures, as well as copies of laws in other states. All these data mean simply nothing to our great Iowa Legislature, which simply will not consider any safety measures applicable to motion picture theatres.

Any Assistance Welcome

We will not, of course, give up the fight, and we are planning to again present our safety measure bill at the next session of the Legislature in 1943. Meanwhile, we are continuing to amass data on every film fire in the State, and if these continue at their present alarming rate, we shall have plenty of evidence to support our contentions.

We probably have all the material anent theatre safety measures that has ever been published, having accumulated it from local and state organizations all over the country. We hope to be successful someday in passing a law which will afford some measure of protection to theatre patrons and projectionists, and if there be anybody or any organization who can be of assistance to us, we shall be grateful indeed.

Meanwhile, the situation in this respect in Iowa is extremely grave and one that calls for careful consideration by projectionist organizations irrespective of where they are located. A successful campaign in Iowa would go far toward strengthening the hand of the craft on a nationwide scale.

W. E.'s NOVEL TUBE FILM

(*Continued from page* 17)

product of individual enterprise and the American way of life.

"A Modern Aladdin's Lamp" is no mere propaganda film in the usual sense of that term. It seeks neither to sell Western Electric tubes nor to sell the W. E. organizational structure. Rather it is a purely educational effort: in fact it was designed and executed primarily for showing before groups of engineering students. Because of this fact, in addition to its superb content and extreme lucidity, it is a "natural" for showing before projectionist organizations everywhere.

Obtaining this novel film, prints of which are available in either 16 mm. or 35 mm. width, is simplicity itself. A projectionist organization need only apply to the nearest Bell System telephone office and a print will be made available free of charge almost immediately. This is a bet that should not be overlooked.—J. F.

Straw in the Wind

Projection equipment, including both visual and sound reproducing units, have been placed on the priorities critical list by the Priorities Division of the OPM. The "critical list" is a compilaton of materials on orders for which Army and Navy contracting officers may automatically assign preference rating certificates, thus assuring prompt delivery for military purposes.

In future, therefore, orders from both the Army and Navy will take priority over commercial orders for all projection equipment, even if the latter had been ordered long before and cash paid therefor.

DeVry Sons New Officers of the DeVry Corp., Chicago

William C. DeVry, 32, has been elected to the presidency of the DeVry Corp., of Chicago, succeeding his recently deceased father, Herman A. DeVry. Another son of the founder, Edward B., has been named secretary-treasurer of the corporation, in addition to being named president of its educational subsidiary, DeForest Training, Inc.

Both the DeVry boys bring a wealth of experience to the conduct of DeVry Corp. business, having served extensive apprenticeships in the field under their father.

DETROIT CLUB'S NEW OFFICERS

Screen Craft Club, social organization of Detroit projection men, has elected as new officers: President, Russell Ruben; Vice-president, Nat Goldstaff; Secretary-treasurer, Sol Goldberg; Recording Secretary, Manny M. Schare, and fifth member of the Board, Gus Cohen.

Plans are under way to resume activity as a bowling league, dropped about three years ago. This will give Detroit three bowling leagues composed entirely of film men.

IP AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

EVEN if one would talk every day upon the evils of excess lubrication around sound equipment, he couldn't talk too much. Here's a case which is very pertinent and illustrates the reason why projectionists should be very careful to guard against over-lubrication and always have a waste rag constantly at hand.

The theatres reported motor speed varying at regular intervals. The speed of the motor would increase above normal. Everyone knows what this does to sound. I found the trouble to be due to excessive oil on the motor commutator, whence it had arrived *via* this route:

The drive bearing had been pumped full of oil, and the excess oil had run out of the bearing and onto the flywheel. As the flywheel rotated, the centrifugal force caused the oil to rush to the periphery of the flywheel and be thrown into space. Much of the oil fell on to the motor and ran down through the brush holders and other crevices to finally alight on the commutator. Enroute the oil had picked up carbon dust, and by the time it collected on the commutator it had formed a thin paste which had shorted the commutator bars.

Although in this instance the trouble occurred with one of the commutator-style drive motors, a similiar excess oil condition will cause just as serious trouble with an induction-type motor by collecting on the centrifugal starting switch. Oil on the latter often actually causes a motor to burst into flame, particularly when it is laden with dust and carbon. — J. J. CARROLL, *ALTEC, Newburgh, N. Y.*

• • •

A theatre reported several arc failures during the day and also during the evening performance. The cause of one failure appeared to be a burned-out ballast resistor. At another time the cause appeared to be a blown fuse. If only one failure had occurred, either of these causes might have been accepted as the basic seat of the trouble and replacement of the defective fuse or ballast lamp to be expected to provide a permanent correction.

However, repeated failure on the same day pointed quite definitely to some other hidden transient defect as being at the bottom of the trouble.

Investigation revealed that the mica insulator of the negative carbon holder of the No. 1 lamp was chipped and that copper deposit from the Suprex carbons had accumulated in the gap where the insulator was chipped. The copper deposit at times would cause a short-circuit to ground. When this occurred, either the fuse or the ballast resistor would burn out and the arcs be lost.

After cleaning out the copper deposit, no further failures occurred. Later the defective mica insulator was replaced as a permanent correction. — J. B. PESEK, *ALTEC, Chicago.*

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Projectionists should be careful when using commercial window or glass cleaner. If the glass to be cleaned is hot, the cleaner will usually leave a permanent oil film. This is especially true of reflectors, since they get quite hot in a short time. Shop around a bit for your "Kleenex" or similar tissues. Most brands leave lint, but a few are lintless.—A. A. MCCROSKEY, *RCA, San Francisco.*

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Many projectionists oil the pressure roller of the rotary stabilizer sound take-off by using a small paint brush with the end bent at right angles just above the brush. This usually gets oil every place but in the bearings.

The method I prefer is to take a piece of wire (about No. 18) approximately seven inches long and make a small loop in the end, just large enough to hold one drop of oil. This wire is bent at right angles one-half to two-thirds of an inch above the loop, the same as the brush was, so as to get into the bearing. This contains only the one drop of oil, and not a whole brush full, and drops it only at the point touched, which in this case will be the bearing.

This gadget is also handy for oiling pad rollers and any other out-of-the-way points requiring only a drop or two of oil.—P. C. MCGAUGHEY, *RCA, Boston.*

• • •

I keep a 25-mfd., 475-volt filter condenser in my kit at all times. To this condenser (which is of the insulated type with insulated leads about ten inches long) I have two insulated clips attached.

If an amplifier suddenly develops a hum, this condenser can be clipped on the various condensers (even with the show still going) and the chances are a point is found where the hum is eliminated. This "portable" condenser is then left clipped on until a regular replacement is secured.—J. R. MCLEMORE, *RCA, Roanoke, Va.*

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It is often the little things that cause the most trouble. When the sound system is completely shut down and admissions refunded to the audience, as was the case in an emergency call I answered the other day, one is apt to start looking for failure of some large and generally considered vital element such as a transformer.

The system involved in this case was a PG-105. The trouble was no sound. All terminal voltages were below normal. I found the trouble was due to deterioration of the rubber cushion supporting the first stage socket in the main amplifier. Deterioration of the rubber allowed the socket to settle, which caused one of the grid contacts to become grounded causing a sound outage.

The condition was temporarily corrected by putting some rubber bands around the socket support so as to relieve the ground.—I. E. RICE, *ALTEC, Charleston, W. Va.*

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If you run into a condition of fluctuation in sound output of a PG-91 System, check the contact between the connecting clip and the tip of the tungar bulb in the power unit.—G. B. BROWN, *ALTEC, Downers Grove, Ill.*

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The other day we had a case of trouble with noise. The noise coming from the screen resembled gear noise which indicated that it was being

picked up by some microphonic element in the sound head.

Investigation showed that the exciter lamp was not locked in its holder; that it was loose so that the normal vibration of the projector caused it to bounce around, and in turn, the image of the lamp filament to bounce around on the slit of the lens tube. Since the "bouncing around" was in step with the gear vibration of the head, the result was a gear-like noise in reproduction.

This trouble was similar to the troubles which were common in the old days due to microphonic tubes used in head amplifiers. — C. W. KENT, *ALTEC, Brooklyn, N. Y.*

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Recently I ran into a situation where both the positive and negative carbons of one arc lamp would burn up at a very rapid rate whenever the other lamp was struck. Obviously, there was a definite inter-action between the two lamps.

Investigation showed that the rheostats of each lamp were in the opposite legs of the D.C. supply, and, further, that the negative carbon holder of each lamp was grounded because of burned out negative Universal shaft insulator blocks. What was happening was this: No. 1 rheostat was being shorted out by No. 2 negative carbon post, and *vice versa*. — WILLIAM C. GOODWIN, *ALTEC, Philadelphia.*

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OFTEN, as an emergency expedient to keep the show going, a defective part which is not indispensable to operation is cut entirely out of the circuit. Many people will argue that no price is to great to keep the show going, and this is probably true. However items in an amplifier or other electrical circuit which happen to fail, should not be cut out without full realization of what is being done and full knowledge of what accompanying hazards may be embraced.

For instance, the other day in answering an emergency call it was found that a choke coil in the filter circuit of the main amplifier had open-circuited. The open circuit meant that plate voltage was not being delivered to the amplifier tubes and therefore there was no sound. Weighing all the circumstances involved, the serviceman decided to cut the choke coil entirely out of the circuit and thus was able to immediately restore sound with the only ill effect being an increase in hum.

The serviceman knew, however, that in shorting out the choke coil he was taking a chance. The filter circuit of the amplifier was one which is known as a "choke input" circuit. This means that the output of the rectifier tube feeds directly ino a choke coil as the first element in the filter circuit. Now, a characteristic of a choke input filter is that if the choke coil is cut out of the circuit the voltage on the condensers of the filter circuit will be increased, possibly increased enough to cause danger of a condenser breakdown.

That's just what happened in this case. Although after cutting the choke coil out of the circuit the serviceman immediately rushed to a nearby supply house to procure a substitute choke coil, by the time he arrived the condensers in the filter circuit had also failed.

This story is told simply to put over the moral that one should be thoroughly acquainted with any circuit he tampers with and recognize the odds involved. In the above case the filter condenser might have operated satisfactorily for a long time but they didn't.—W. W. SIMONS, *ALTEC, New York City.*

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Copper-sulphide rectifier troubles: Rectifier 65-65 Amperes from 220-60-3-phase line. Complaint: rectifier fan slow starting and running in reverse. Maximum of 30 amperes available at lamps instead of usual 60, and practically impossible to hold arc. Cause: Operation on two phases of supply due to failure of one blade in three-blade knife switch — a fancy gadget, not too accessible. — F. J. PFEIFF, *ALTEC, New York City.*

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Simplex recently made a real improvement in the G-112-G Main Drive Gear, calling it now the G-308-G. Its use calls for a modification of the associated A-1 or A-11 shaft, that makes the latter unfit for use with the G-112-G Gear. Many theatres have this type (G-112-G) on hand as a spare. It can be used satisfactorily in an emergency by a slight change in the C-126-A Main Drive Gear Clutch, which is removed from the A-1 Shaft when it is modified for the new gear.

The procedure is simply to turn off a portion of the plain face of the clutch approximating the thickness of the steel washer that is used in its place with the new gear (1/16"—.0625). Then a slot is cut in this face down to the tapered hole so that it will engage the P-115-A Driving Collar Pin, in the modified shaft. With this slotted clutch in place, the G-112-G Gear can be mounted and normal operation obtained.—F. J. PFEIFF, *ALTEC, Hamden, Conn.*

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AS WE all know, magazine valve rollers have a habit of collecting lint and other dirt. This usually sticks to the sides of the holder, and is difficult to clean without taking the assembly apart. Here is a way that works beautifully. Take a piece of film about a foot long, and cut one edge off so that the sprocket holes are exposed like a saw tooth edge. Run this piece of film between the rollers, and this saw-tooth edge literally saws out any dirt present.—E. A. DOYLE, *RCA, Portland.*

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Here's a case of unusual noise trouble, one of those things "for the book," because it is the unusual cases of noise that are responsible for headaches.

One of my theatres reported hum in the sound of one machine. After thorough checking, I found a 4-volt difference between the neutral wiring of the A.C. power circuit and true ground. The noise was the result of leakage through oily tape of a splice in the wire.

The condition was corrected by washing that section of the wire with Pyrene, resoldering the splice and retaping it. —W. S. WELSHONCE, *ALTEC, South Ozone Park, N. Y.*

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Human ingenuity apparently knows no bounds. One of my theatres reported trouble with arcing between the prongs of a power tube and its socket. The arcing was serious, and caused all the meters to jump.

When I arrived at the theatre I found that the projectionist had really taken the "bull by the horns" and corrected the condition, temporarily at least, with one masterly stroke so as to save the show. He had actually soldered the two prongs to the socket contacts.—A. W. ALEXANDER, *ALTEC, Asheville, N. C.*

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The next time you have trouble with an induction motor failing to operate properly due to dirt or excess oil on the centrifugal starting switch, and don't wish to close the show down by dismantling the motor, try squirting some carbon tetrachloride on to the switch from the outside.

This expedient often will clean the switch sufficiently to allow operation during the remainder of the show, after which the motor can be dismantled and the switch properly serviced.—L. J. PATTON, *ALTEC, Teaneck, N. J.*

P.E.C. Deep Purple

Much has been said about how one type of defect causes another to develop, and that that which appears on the surface is not the whole trouble. This is a case of trouble with Webster amplifiers. The theatre reported no sound and stated that when the amplifier was turned on the photoelectric cells turned a brilliant purple.

Evidently one of the 2-A-3 tubes had short-circuited. This burned out the cathode resistor. The opening of the cathode resistor put the entire stage out of commission, thus relieving the power supply of the load of the stage. Relieving the load of the voltage power supply caused the PEC potentiometers to burn out, which in turn allowed an excessive plate potential to be applied to the photoelectric cells, which in turn turned purple.—L. C. TYACK, *Altec, Oklahoma City, Okla.*

The EDITORIAL PAGE

Vol. 16, No. 4 APRIL 1941

The Craft's Splendid Job-Loyalty

If ever definite proof were needed of the unique character of motion picture projection work, no less than of the unique character and unmatched job-loyalty of those who follow this profession, that proof is at hand in the circumstances attendant upon the current series of lecture-demonstrations on the Simplex E-7 projector sponsored by International Projector Corp. for the benefit of local union projection groups in key cities. To date, the demonstrations have been given in such centers as Buffalo, St. Louis, Pittsburgh, Washington, Cleveland, and Westchester County, N. Y., with projectionists from surrounding territory being invited to attend. IPC promises to extend the scope and enlarge the territorial range of these demonstrations so as to service a majority of projectionists.

There has been much comment of late, both within and without the craft, concerning the almost total lack of educational activities by organized units of the craft during the past few years. The reasons ascribed for this reversal of custom are varied and interesting. Some hold that the craft thrives on opposition, but that recent years have seen the gradual diminution of non-union opposition. Others charge that equipment manufacturers are interested solely in sales, and that neither before nor after a sale is made do they take the slightest interest in either the proficiency of the man in charge or in the continuing smooth operation of their units. Still others hold to the "What's-the-use?" point of view, the idea being that Mr. Exhibitor will neither know nor care whether his crew advances in craftsmanship or not. There is probably some truth and some error in all these opinions.

But whatever the reason, the fact remains that the craft always stages a comeback, or, rather, rebounds from the slough. These are troubled times, with much to occupy and concern any group of workers. This is particularly true of theatre workers in view of the fact that the economic health of the industry is quite a bit below par. Still, we witness the sight in a score or more of cities of as many as 300 men gathered together at midnight, after a day's work and long after the people they serve are tucked away in bed, to listen, and avidly, to a technical lecture which serves only to improve the art and the craft and puts not a *sou* into the pockets of the listeners. And these sessions are no taffy-pulls, either, because both the lecturer and the audience must be on their toes and ready to lay on the line the facts anent a given question. No one who has ever attended one of these midnight sessions can doubt for a minute the deadly earnestness of projectionists about the whole proceeding.

For IPC there can be only the highest praise for sponsoring this series of lectures on the Simplex E-7, and particularly at this time. It is an open secret that IPC is now engaged in large-scale contributions to the national defense; and it is equally well-known that the level of strictly projection equipment sales has left something to be desired within recent months. But it is precisely because of these reasons that IPC has launched this current educational program, in order, to quote the company directly, "that the great gains scored by the projection field within the past years shall not be lost, and that progress in the art shall continue." No one could ask more from any manufacturer; no one could ask for more tangible proof in the form of effort, expense and sincerity that a manufacturer really "belongs" to the industry in which he operates, and that he is willing to contribute his bit to the continuing advancement of that industry. It is regrettable that more equipment manufacturers do not adhere to this view.

The organized projectionist craft has never suffered any lack of detractors, and the brickbats that have been tossed at its collective head during its existence would ruin any ordinary group of workers. In fact, this corner has itself not infrequently despaired of whipping up a sustained craft interest in things technical—which confession borders dangerously on an expression of disloyalty. Yet, just about when the low point in this swing of opinion has been reached, and just about when the craft is being maligned to a point where the uninformed conclude that its members are a bunch of pariahs, the craft comes up with a fresh demonstration of its virility and essential stability as a potent industry factor. Any group of craftsmen that can stage this showing of morale need fear neither for its continuing existence and success nor for any maligning that is directed at it. Nice going.

The Score Anent Theatre Television

Let's get straight this matter of our opinion about the worth of theatre television, concerning which not a few comments have been received from the field. We have never stated that television would *replace* the motion picture theatre. We did say that it could and undoubtedly would be used as an *adjunct* to existing film theatre fare. We did say that when so utilized theatre television would cut down the need for film prints by exactly the number of hours weekly it was used. We did say that the televising into a theatre of musical comedies, sporting events, and other programs of national interest appeared to us to be entirely feasible and economically sound. It seems to us crystal clear that any theatre on a television circuit some distance removed from New York can get $1.50 admission for the large-screen televising of a big Broadway musical show. First-line sporting events are "naturals," of course.

Current Film B.O. Slump Evokes Industry Howls

The current serious slump in box-office takes by film theatres, averaging 30% is inducing no little caustic comment on the part of exhibitors and distributors, with each group laying the blame at the doorstep of the other. "Bum pictures," shriek the exhibitors. "Inefficient merchandising, double and triple features, giveaways, poor presentation," reply the producer-distributors.

Placement of the blame, however, in no way minimizes the seriousness of the slump. So acute is the situation, in fact, that many distributors are advancing the release dates on big, expensive pictures until Fall in the hope that the percentages netted then will enable them to at least break even. Government admission tax collections are away off the level of a couple of months ago, and still falling.

The defense spending program has yet to make its effect felt, even in those areas having the greatest concentration of heavy industries. Recent surveys tend to support the view that in many quarters the workers are just now getting out from under the load of debt assumed in previous years while they were unemployed. Paradoxically, the Army men who receive only $21 monthly are helping build fancy grosses in cities and towns adjacent to cantonments, especially on weekends.

Critics on both sides of the fence are not short on suggestions as to what needs to be done to revive sagging box offices, but neither are they long on ideas as to just how to make such policies effective. Everybody is agreed on one point: grosses should be upped considerably. How? is the pressing question.

Novel Depth Process Shown in New U. S. Patent

Three dimensional films may be brought closer to perfection through an invention that recently won a U. S. patent for a Mrs. Suzanne Carre of Paris. Mrs. Carre's claim is to eliminate the need of special glasses or use of sighting devices, such as those used for Audioskopics shorts produced by M-G-M, in order to create the effect of depth in pictures.

Her device is made up of a reciprocating grid placed in front of the screen, between the latter and the audience. The grid is composed of thin rods or wires, spaced apart at a distance equal to their width. An electric motor synchronized with the shutter of the projector reciprocates the grid back and forth across the screen.

Rear Projection, Alternate Images

Films would have to be projected from behind the screen. Thus, pictures corresponding to views seen by the left eye and the right—so called left- and right-hand pictures are—projected alternately in succession. As the pictures are projected, the grid is reciprocated back and forth across the screen by the motor operating through a crank.

Each bar of the grid successively cuts off the parts of the screen occupied by the space between the bars during projection of the

proceeding frame. Such movement of the grid is claimed to give a perfect impression of depth.

[ED.'s NOTE: Refer to "Russia's Three-Dimensional Motion Pictures," elsewhere in this issue.]

IPC Sales Chief Promises Full Projectionist Aid

In a general letter to all projectionist organizations, Arthur E. Meyer, general sales manager for International Projector Corp., expresses regret that the exigencies of the National Defense effort, in which IPC is playing an important role, make it necessary to close the plant to visitors. Tours of the Simplex quarters have long been popular with projectionists visiting New York City, particularly during the vacation period.

Although IPC is busy with defense orders, continues the Meyer statement, "regardless of any conditions we intend to maintain the high standards which have won world-wide recognition for Simplex projectors, and it is our purpose to see to it that the great gains which projection and projectionists have made for many years shall not be lost."

The Meyer letter points to the series of demonstrations now being given by Simplex representatives in key territories throughout the country as a practical example of IPC's determination to further projection progress, and adds that constant contact with and full information for all projectionists who are unable to attend any of the aforementioned meetings will be afforded through the medium of bulletins obtainable from either IPC or its distributors, National Theatre Supply Co.

Radically New Lens Glass By Eastman Kodak Co.

A radically new glass for lens-making, produced without the silicate heretofore composing glass and possessing increased capacity for bending light rays, has been developed by Eastman Kodak Co. and incorporated in lenses designed for the Government.

Almost as revolutionary as if someone had discovered how to make steel without iron, according to Eastman sources, the new optical substance is the first basic optical-glass discovery since 1886, when the famous Jena glasses were introduced in Germany. Tantalum, tungsten and lanthanum, all considered normally as rare metals, are used to produce the new glass. The new glass puts an important new medium at the disposal of optical designers, it is said.

Glass is described as possessing a much higher refractive index than previously available. In common terms, its light-bending ability is much greater. The consequences, as shown by service tests of aerial lenses in which the new

glass has been incorporated, is better "definition" in pictures and a larger area covered, yet with no loss of lens speed.

Some time may elapse before the new glass is found in wide and general use for photographic lenses, according to Kodak officials.

E. S. Hawes, Altec engineer at Memphis, is the proud pappy of a daughter, Cynthia Jane.

Fine-Grain Film to be Used on all Major Features

Probability is that major studios on the West Coast will use fine-grain film for all forthcoming feature prints. Led by Paramount, which a year ago experimented with this reproduction medium on the pictures "Geronimo" and "The Great Victor Herbert," and which is now on a 100% fine-grain feature production basis, the major studios have concluded that this base offers exceptional opportunities for improvement.

Among the improvements effected by the use of fine-grain film, according to Loren Ryder, recording chief for Paramount, are its finer definition, improved sound, and the elimination of graininess. It also makes the hitherto undesirable front seats in a theatre a spot where the picture can be enjoyed as well as from a seat farther back in the auditorium.

So successful were the trials of the fine-grain film with the aforementioned features that Paramount was willing to spend considerable money in revamping studio and laboratory equipment to put it into general use.

Extra Equipment Not Needed for "Fantasia," Says RKO

No additional equipment "in any way, shape or form" will be necessary in those theatres which have contracted for the general showing of "Fantasia," according to advices from the RKO home office. The quesion arose when it was recalled that the original roadshow bookings of this Disney film required elaborate special sound reproducing apparatus to accommodate the separate film sound tracks utilized for this opus.

RKO explains that "technical improvements" now make it possible to incorporate the original three sound tracks into one print, which, of course, can be projected over standard equipment. This new arrangement is referred to as a "modified Fantasound."

[Ed's. Note: Despite the aforementioned assurances by RKO, it should be borne in mind that "standard equipment" will fall far short of delivering the splendid results inherent in "Fantasia" recording as attained in spots where special equipment was used.]

Picket Theatre 4 Years

William Flynn and Robert Antonelli, members of I. A. Local 223, have received $42 weekly for picketing seven-and-half hours daily seven days a week for four years, according to a U. P. story.

The men have worn out 14 pairs of shoes —not including numerous resoles—since they started picketing the Hope Theatre because it refused to deal with their local.

Almost celebrities now, Flynn and Antonelli gossip with neighbors and mind babies while mothers shop nearby. Hardest day on the job, they say, was during the 1938 New England hurricane when they were blown two blocks from the theatre.

Flynn says he is not resentful when friends pass through the picket line to attend the theatre because "It's the principle of the thing we're out here for." Antonelli doesn't know how long the picketing will continue but "four years or ten years is all the same —when we picket, we picket."

L. B. MAYER'S TOP U. S. WAGE

For a fourth successive year, Louis B. Mayer, Loew's production chief, was America's top executive salary earner, according to statistics made available by the SEC. Mayer had no close competition for first place.

Mayer's 1940 remuneration was given as $697,049. In 1939, Loew's, Inc., paid him $688,369; in 1938, $688,369.45, and his remuneration in 1937 was tops for that year. In 1940, $541,049 of the $697,049 represents a share in the profits of the company.

The second highest on the pay list was Eugene G. Grace with $478,144 as president of Bethlehem Steel. George W. Hill received $456,415 as president of the American Tobacco Company and appeared to be a safe third.

Other 'Modest' Film Wages

Income of other film personalities for 1940, as reported by SEC, were:

Hunt Stromberg, $332,267, from Loew's, Inc.

Nicholas M. Schenk, $318,881, from Loew's.

W. C. Fields, $255,000, from Universal.

Deanna Durbin, $209,833, from Universal.

Bing Crosby, $150,000, from Universal.

David Sarnoff, $100,900 from RCA.

LOEW'S 5 MILLION NET

Net profit of Loew's, Inc., for the 28 weeks ended March 13, 1941, was $5,141,-135, compared with $6,789,828 for the corresponding period last year. Per share earnings on the preferred stock for the 28 weeks ended March of this year were $37.60, while the per share average on common stock was $2.80.

POWER SHORTAGE FELT MOST IN SOUTHERN STATES

Hardest hit area in the rapidly developing power shortage situation is the South, with conditions particularly acute in Georgia and in Tennessee. In Atlanta theatre marquees now only have barely sufficient light to announce the feature attraction, and flashers are conspicuous by their absence. Also, theatre cooling plants have been cut down to about one-half their normal level, and all theatre lights except those needed for safety reasons have been doused.

One novel means of combatting the power shortage while at the same time helping the theatre business is advanced by Lee Rogers, film critic of the *Atlanta Constitution.* Rogers advocates a save-power-by-going-to-the-movies campaign, his idea being that thousands of kilowatts of power will be saved by Atlanta families who turn off their house lights and attend the movies *en masse.*

The power situation is not serious as yet in other sections of the country. In fact, an official of the Edison Institute, of New York, which presumably keeps close check on power consumption nationally, characterized the stories anent a power shortage which emanated from Washington as "damned nonsense".

MODERNIZE ACADEMY REEL

The Research Council of the Academy of Arts and Sciences has announced the availability of a replacement excerpt, consisting of new dialogue recording, to be included in the Research Council Theatre Sound Test Reel (ASTR-2). All exhibitors, theatre circuits and sound equipment companies who have previously purchased prints of the Reel may now obtain this additional recording; all prints of the Reel released in the future will also include the new excerpt.

As part of the theatre sound standardization program, the Council plans to continue to make available from time to time new test reels and new tools to assist the theatres in maintaining the best possible sound quality.

EASTMAN'S 10% WAGE BOOST

Approximately $4,000,000 will be added to the annual payroll of Eastman Kodak Co. by a current wage and salary increase. Employes now earning up to $3,000 annually will receive higher pay, and the increase will amount to about 10 per cent per employe.

The great majority of those affected by the increase are in Rochester, where more than 19,000 Kodak people work. The increase will also enlarge such employe benefits as retirement annuities and life insurance.

NEW RCA RECORDING DISC

Many tons of aluminum have been freed for use in the national defense program by the success of RCA in perfecting a new 16-inch fire-resistant, paper-core recording blank for use in radio studios, airline terminals, and other locations where sound is recorded for "reference" purposes. The new disc is thinner and lighter than the aluminum-core blank, and is being sold at one-half the price of the old type of record.

The new blank provides a quality of reproduction that is unsurpassed by any other paper-core blank, no matter of what size. It has an amazing flexibility which prevents warping and allows the disc to flatten out at the mere pressure of the cutting head. The disc itself is slow-burning because of the paper core, and the shavings will not support combustion. With no fire hazard involved, the shavings can be thrown into any rubbish can. Its cutting surface permanency is assured, since the secret formula lacquer will not harden with age.

RKO'S $643,000 QUARTER NET

RKO Corp. and subsidiary companies showed a net profit of $643,926.07, after all charges, for the 13 weeks ended April 5, 1941, organization channels disclosed recently. This compares with a net profit of $535,088.10 for the 13-week span ended March 30, 1940.

Profits from operations, after deducting depreciation and income taxes in the aggregate sum of $548,813.48, amounted during the 13 weeks ended April 5, 1941, to $717,119.82. Operations profit, after similar deductions in the corresponding span of 1940, was $609,538.35.

OFF WITH THE CHAPEAUX

Brazilian exhibitors have decreed that femme patrons henceforth must remove their chapeaux. Brazilian hats run to high ornaments making it difficult for people in the rear to see the screen.

I.A.-A.F.M. Pact vs. 'Soundies' Held Unlawful in N. Y.

THE combination of musicians and stagehands, by means of a working agreement no matter of how long standing, to prevent performance of "canned" (recorded) music in place of musicians is unlawful, according to a recent split decision of the New York State Court of Appeals. The ruling reversed an appellate decision which upset a lower court's injunction preventing the two internationals — A. F. of M. and I. A. T. S. E.—from combining against the road companies of Opera on Tour. The latter utilized live performers in conjunction with recorded (disc) music.

Stagehands Halt Tour

The case developed when a road company of Opera on Tour was halted in Birmingham, Ala., by a strike of stagehands which was precipitated by a demand by the A. F. of M. and that the I. A. respect the provisions of the year's-old working agreement between the internationals. Following further trouble with stagehands enroute, the opera company suspended its tour and returned to New York, where an injunction against both internationals was sought.

This injunction was granted by New York Supreme Court Justice O'Brien. He said he saw "no labor dispute" between the opera company and the two unions; that they had no right to "enter into any plan or scheme to prevent" the opera company from doing business; and he called the I. A. action an "exercise of arbitrary power."

'Legitimate Endeavor of Labor'

Subsequently, the New York Appellate Division reversed Judge O'Brien's decision, with Justice Callahan remarking:

"The defendants (the unions), in order to secure what they believed to be their economic betterment, are endeavoring to prevent the use of a mechanical contrivance, which is in the nature of a labor-saving device. Such conduct on the defendant's part is justified as a legitimate endeavor of labor, even though it results in some injury for the plaintiff (the opera company)."

Justice Callahan added that "there are those who question the fact that we "progress where we use machinery to such an extent that we destroy the opportunity for men to live by employment, and thus create vast numbers of permanently unemployed."

The recent decision by the N. Y. Court of Appeals, which will probably conclude the case, was written by Justice Finch, and concurred in by associate Judges Lewis and Conway. A dissenting opinion was offered by Chief Judge Lehman, supported by associate Judge Loughran.

'An Unlawful Labor Objective'

Judge Finch said, in part: "For a union to insist that machinery be discarded in

order that manual labor may take its place and thus secure additional opportunities of employment, is not a lawful labor objective. . . . There is involved in the case at the bar solely the demand that a new enterprise shall not make use of machinery in order to create places for live musicians.

"Neither in the previous judicial decisions of this court has it been held, nor in any statutes enacted, that a dispute is a labor dispute which has no connection with, or relations to, terms of conditions of employment, collective bargaining, protection from abuses, or respective interests of employer and employee. In the case at bar, there is no actual employment at all."

He also said that the "right to strike" was not involved in the case, adding "the leader of a labor union cannot make an illegal objective legal merely by use of a legal method (the strike) to obtain that objective."

Right to Strike Held Infringed

Chief Judge Lehman differed with this view, in the dissenting opinion, by saying that Judge Finch's ruling was an "injunction against a strike and nothing else." He further said:

"The controversy here is no less a labor dispute because the strike of the plaintiff's employees is primarily to assist members of an affiliated union in the same industry, in an economic conflict, for the purpose of procuring employment. That is a dispute 'concerning employment relations' and under the express terms of the statute is clearly a labor dispute."

Novel Work Relief Plan Operated by L. U. 306

The unique method of work relief for the unemployed which has been developed by and is operated by I. A. Local 306 of N. Y. City has attracted much attention and no little favorable comment in craft circles. The scheme embodies the utilization of paid vacations which are an integral part of the contracts negotiated for those men regularly employed.

The plan was instituted several years ago with a contract signed with the major N. Y. theatre circuits which provided that all projectionists were to receive one week's vacation with pay. This vacation work was then distributed among the unemployed from a rotating list on which each man places his name. Upon receiving work, the man's name is automatically dropped to the bottom of the list. Work is given out twice each day at official roll calls.

Subsequently the plan was extended when a similar contract was signed with all the independent theatres in N. Y. City. In 1940, revision of the contracts with both major circuits and independent exhibitors resulted in the vacation term being extended to two weeks with pay.

Today, Local 306, without any assessments, special unemployment taxes, or the surrender of working time by the regular men, is taking adequate care of those not regularly employed by means of the 4000 weeks of vacation work secured in contract negotiations.

NATIONAL DEFENSE EFFECTS ON PROJECTION NEEDS

(*Continued from page* 16)

business what his factory is making for the government, in addition to making projectors. He won't tell you. But you know that airplane parts and automatic gun parts, are machined to a tenth of a thousandth. Projector factories and projector parts factories can work to such tolerances. Few other industries can.

Amplifiers, although not theatre types, are on the priorities lists, and the same is true of sound equipment in general. The same is true of electric motors other than standard commercial types; and the makers of the standard commercial types may be kept busy turning out the special types.

Consider the problem of an amplifier manufacturer. He'll have the same trouble getting condensers, tubes and so on for non-government use that you'll have getting them for repairs. In addition, his manufacturing facilities are busy on rush government orders. Then

you come along and want a new sound system. You'll get it. With delays and substitutions in component parts. But if you're likely to need one in the next couple years, how about getting it now?

General Precautions

All of the foregoing adds up to taking three basic precautions at the present time.

1. If anything necessary for projection — projector, lamphouse, sound equipment, motor generator—anything indispensable, is likely to need complete replacement in the next year or so, this is a good time to put in the replacement.

2. If anything necessary for the projection room is likely to need a factory overhaul in the next year or two, have it done now. They still can put in first-rate parts. They can still give real time to the job. And they can still do it without unreasonable delay.

3. Stock spares. Go over the entire projection plant, noting at every point what repair parts may be needed at times. Check those parts against the details discussed previously. If they are likely in the future to prove scarce, or of inferior quality, or slow to get—put in a supply now.

If these three precautions are not observed, experience tells what is likely to happen. For such experience it is not necessary to go back to the last war. The theatre industry knows of a special case that duplicates the same conditions. When sound was very new, sound parts were hard to get. This writer has personal knowledge of a West Coast theatre that closed down for three days *over the Thanksgiving week-end* in 1929 because a rectifier tube burned out. There wasn't a spare to be found in the state. Doubtless some theatre somewhere had a spare, but they couldn't locate it. They stayed closed and lost their holiday business until spares came to them from Chicago. And the projectionists, of course, lost three days pay.

That was a special case of what apparently is going to become a general, nation-wide condition. It is a condition to prepare for. Anything may prove slow to get—anything. Play safe, keep the spare parts box full up. Many things will be available only in inferior quality. Play safe, stock up now.

Electric Power Supply

A bottleneck insufficiently appreciated is the supply of electric power. There is barely enough now. As more factories pass out of the tooling-up stage into full production, there will be less than enough.

That, as a matter of fact, is why aluminum and magnesium are scarce. There are limitless supplies of both—in the ore. Getting them out of the ore in-

volves a process of electroplating them out; there is no other way. And electroplating thousands of tons of metal takes enormous amounts of current.

Great networks of electrical supply, interlocking distant communities, exist and are being expanded. Hence, even a theatre at a crossroads hundreds of miles from industry may find its voltage curve doing a handspring when aluminum plants or other plants switch on and off, very far away. Some of the best steel is now made or treated in electric furnaces. The demand for power is rising much faster than the supply can be increased. And that power is being consumed in large blocks. These two facts mean that a single switch thrown in or out can seriously affect the voltage of the line. The interlocking of distant sources of supply into great networks means that the effect can and will be felt not only near the industrial plants that cause it, but also in remote places.

The harmful effect of voltage variation on projection room performance and equipment is well enough known. Sound volume varies. Projection light may or may not flicker, depending on the nature of the arc source.

Equipment suffers. High voltage leads to burn-outs. Low voltage makes it necessary to run with the volume control turned abnormally high. This in itself is often undesirable with respect both to the equipment and to the quality of the sound. When the volume control has been turned up because of low voltage, and the voltage rises suddenly because some near or distant plant is going through a change of shift, the result is a combination of inferior sound and danger to equipment.

These faults, of course, will be accentuated if substitute apparatus must be used in projection because of emergency shortages.

Those projection rooms which in the past needed voltage controls but did not put them in, certainly must get them now, and many projection rooms hitherto able to get by without voltage controls will need them from now on. In this connection, however, note that the voltage control device is itself a piece of electrical apparatus, composed of materials and parts subject to priorities and emergency shortages. It is made in factories that are capable of making, and do make, things for the government.

Therefore, you may find that as the need for voltage control devices in your projection room increases and becomes more urgent, those devices will become scarcer and harder to buy. If your projection room now suffers in any appreciable degree from fluctuation of line voltage, play safe and ask the boss to put in controls.

If you have no serious trouble in that way, play safe and contact the power company, or ask the boss to do it, and find out what are the chances that regulation will remain good in your community. If the chances aren't excellent, a voltage control device may turn out to have been mighty cheap insurance.

In addition to the trouble, breakdown and poor shows likely to result from emergency-era power supply working

through emergency-era parts, the mere cost of replacements resulting from burn-outs under those conditions will very likely be greater than the cost of putting in controls now.

Price Trend Upward

One phase of this subject has been intentionally overlooked so far, and that is, the prices of equipment and parts. Will prices go up? Will tubes, for example, come to cost so much more that stocking up now is justified merely on the grounds of economy regardless of all other reasons?

This still is a moot point. During the last international emergency, of course, prices did not merely double; they multiplied. And most projectionists remember the cost of sound equipment in the late 20's when it was new and therefore scarce.

Prices of projection room supplies today and tomorrow will of course follow the national price structure. What course that will follow nobody knows as yet—but it is dead sure prices won't go *down*. There are many reasons, as reviewed here, for taking certain precautions now, for stocking up on repair parts and equipment now. One remains to be added: prices for such things may or may not go way up—but it is certain that they will not go lower.

RUSSIA'S THREE-DIMENSIONAL MOTION PICTURES

(*Continued from page* 13)

that they cannot be distinguished one from the other at a distance of ten metres (about 33 ft.) They are, of course, fitted with the greatest mathematical precision, to the hundredth part of a millimetre.

Spectator Position Vital

One drawback of this first stereo-cinema is that each spectator has to find his own viewpoint and stick to it; a movement to right or left, a bend of the head, and the image is lost for the moment. We have already worked out, in theory, a method of getting rid of this defect, and at present we are working on the practical application of this second system.

A stereo-screen has been set up in one of the big Russian cinemas, the "Moscow," where the first stereo-film, "Land of Youth," is now being shown. This is actually a screen concert in which the best of the Soviet musicians and singers take part. The performers can be seen before the screen, in the auditorium itself, and far back in the depths of the screen. Some sections of the film are in color. Some of the cinema studios of the U.S.S.R. have started work on the production of more of these new stereoscopic films.

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INTERNATIONAL PROJECTIONIST

MAY 1941

VOLUME 16 • NUMBER 5

25c A COPY • $2 A YEAR

Looking at the sound picture from the projectionist's port-hole

LOOK TO THE FUTURE WITH RCA PHOTOPHONE SOUND and SERVICE

RCA Panoramic Sound Speaker System

Left—*Present Modern RCA Theatre Speaker System*

RCA Theatre Television Projector

At top—*RCA Photophone Amplifier*

When you think in terms of the future, look back to the past. Think of the progress made in the field of motion picture sound. Compare today's sparkling reproduction with the tinny, unreal sound of the first "talkies." Then remember—RCA Photophone has played an important part in the advance of the art.

RCA Laboratories are constantly engaged in research with an eye to the future. Proof of RCA Photophone "years ahead" design is shown in the latest development of RCA engineers—large screen television—which was recently introduced at the New Yorker Theatre in New York City.

It was not just chance that a standard RCA Photophone amplifier, as illustrated on this page, was employed as a vital part of the equipment used in the New Yorker Theatre.

And it was not just chance that RCA field engineers played a vital role in the preparation, installation and operation of the theatre television equipment.

These field engineers are fundamentally *your* men. Their *first* job is keeping your RCA Photophone Magic Voice of the Screen in first-class condition. And their close association with RCA research and manufacturing engineers naturally makes them better able to do a better service job for you.

So when you look to the future, look to RCA Photophone sound and service—the combination that works together for *you!*

RCA VICTOR PREFERRED TYPE RADIO TUBES
For Finer Radio Performance

AT YOUR SERVICE

RCA Photophone field engineers are always ready and eager to serve you. Backed by RCA research and experience in sound recording and reproduction, the engineer near you will be happy to help you with any problems you may have—and in addition, solicits your suggestions and criticisms for further improvement of RCA Photophone Equipment—the best in the business!

RCA THEATRE SERVICE

PHOTOPHONE DIVISION

RCA Manufacturing Company, Inc., Camden, N. J.

In Canada, RCA Victor Co., Ltd., Montreal — A Service of the Radio Corporation of America

International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

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Monthly Chat

THE receipt of several letters direct from theatre owners and managers relative to the impending projection equipment shortage indicates that not a few projectionists took our tip and passed along to the front of the house the article on national defense needs and their possible effect on theatre supplies, which appeared in our last issue. Also, we are sure that hundreds of projectionists will cooperate with Uncle Sam in conserving electric power, than whom nobody is more strategically located in the theatre than Mr. Projectionist.

Here is concrete evidence that projectionists as a craft consider themselves as something more than mere wage-earners on theatre payrolls, and that they can contribute much to the success of any given operation.

• • •

Don't, please, send lenses which you wish coated direct to this office. I. P. is definitely not in the business of coating lenses. Careful inspection of announcements in I. P.'s pages will put you on the right track.

• • •

Reproduced elsewhere herein is the questionnaire form relative to proposed changes in the Standard Release Print which was circulated recently among I. A. projectionist units by Local 150 of Los Angeles. The latter organization, having close contact with all major studios, is anxious to receive as many of these filled-in forms as possible.

• • •

The growing concern of the organized craft anent the great gains scored by 16 mm. shows during the past year (including both non-theatrical and itinerant travelling units which charge admission) is reflected in the long, and sometimes bitter, discussions on this topic at recent district conventions. A pronouncement from the I.A. General Office as to policy for affiliated units is expected shortly. Meanwhile, the best advice on the situation that we have heard is that where a competitive situation in 16 mm. work is encountered, meet it!

• • •

Producers, distributors, and exhibitors are clamoring for a contribution by the industry's technical forces, "comparable to the introduction of sound pictures," as a means of stimulating box-office activity. They forget, of course, that through the years since 1928 they scorned being bothered with things technical and practically starved those who were seeking money and support for improving technical processes.

• • •

Well, the barrier was sprung on commercial television on July 1 (that is, home television), and we shall now see what we shall see. Two angles are giving the sponsors of tele sleepless nights: the availability and cost of sets, and program material.

INTERNATIONAL PROJECTIONIST

VOLUME XVI MAY 1941 NUMBER 5

First Commercial Television Theatre in America is Rialto, N. Y. City

By *LEROY CHADBOURNE*

THE first commercial theatre television system in the United States is now installed and ready for action at the Rialto Theatre, Broadway at 42nd St., in New York City. It is a British system (Scophony, Ltd.) entirely similar to the many installations that did profitable business in London theatres before the war.

Where all previous American installations of theatre-size television equipment have been only for demonstration or experimental purposes, the Rialto apparatus is intended for public showings. Actual utilization awaits, at this writing, completion of arrangements for programs. These can be received either *via* telephone line or through a dipole antenna which has been erected on the roof of the theatre.

Location of Equipment

An outstanding distinction of the Scophony system lies in its optical arrangements, plus the fact that it utilizes a standard projection arc as its source of light. This principle contrasts strongly with methods previously demonstrated in this country for theatre-size television, in which the source of light is the actual image on the receiving screen of a cathode-ray tube. There is no cathode-ray tube in the Scophony reproducer.

The equipment used in the Rialto Theatre is located on the screen platform, behind the screen, and embodies the principle of rear projection. The apparatus occupies a space approximately 6′6″ long, 2½′ wide, and 6′ high. The length of throw equals the width of the screen image. The Rialto image measures 10′ x 8′.

The television screen is of the standard translucent variety used in Hollywood studios for rear projection, as when an outdoor background is projected behind the actors to save the cost of moving a company to location. Speakers for television sound obviously cannot be placed behind this screen. They are standard radio-type speakers, located at either side of the screen and below it.

Details of the location of the equipment are adapted to the structure and layout of the stage platform. For television, the motion picture screen and speakers are struck, the television screen brought forward. One projectionist operates the equipment. He views the televised picture from behind the translucent screen, seeing it, of course in reverse.

This arrangement will not necessarily be used in other theatres, nor is it expected to be permanent in the Rialto. With more space available, the standard motion picture speakers will be used for television also, the translucent screen being located well forward of the picture screen.

Programs and Admissions

In England, the manufacturers say, standard fight prices were charged for admission to see popular boxing matches in television. The theory was that since the television cameras were located at the ringside, all seats in the theatre were ringside seats. On such occasions, the manufacturers say, the theatres were completely sold out; this despite the competition offered by 100,000 home television receivers capable of picking up the same program. Portable equipment at the ringside, or at the trackside in the case of the Derby races, relayed the program to receivers which transferred it to coaxial cables. Up to the beginning of the war, coaxial cable had been laid between London and Birmingham, and 12 miles of it under the streets of London itself.

The Rialto installation in New York, which incorporates a radio-television receiver, is capable of picking up programs broadcast from the Empire State tower or elsewhere in the Metropolitan area. Programs can be brought over longer distances *via* coaxial cable. It

has also been found that they can be carried over reasonable distances by ordinary telephone line provided corrective amplifiers are installed in the line at intervals of one mile.

The Television Signal

The nature of the television signal is more easily remembered if it is recalled that at the transmitting end the scene to be televised is focussed on a screen in the television camera, and then "scanned" point by point. Each point of the image on the camera screen is represented or reproduced (by the action of the camera) as one pulse of electric current. The strength of that pulsation, the amperage, depends on the brightness of that point on the image. When the entire image has been scanned, point by point, the result is a series of many pulsations of current, of varying strength. This is the signal that is put on a telephone line, or impressed by modulation on a radio-carrier wave.

Scanning is done by "lines," that is, the image is scanned point by point along an imaginary line at the top, then point by point at an imaginary line slightly lower down, and so on until the entire image has been covered.

English and American standards of scanning differ slightly, and in fact there is more than one American standard. The equipment at the Rialto is designed for a 441-line image; that is, the picture is considered as consisting of 441 imaginary horizontal lines. Each line in turn consists of 588 imaginary points. The total number of pulsations necessary to convey a complete image (assuming every point to differ in illumination from its neighbors) would be 441 x 588, or 259,308. Thirty such images are transmitted per second, to convey the illusion of motion; that is, where motion pictures utilize 24 frames per second television uses 30.

The basic television signal, therefore, consists of current of some millions of cycles, the exact frequency depending on the details of the image. Where two adjoining points, scanned successively, have exactly the same illumination no fluctuation is introduced into the current when those points are scanned.

Recalling these details of television in general will help clarify the apparatus represented in the ilustration, where the optical portions of the Scophony system are diagrammed in outline.

Reproduction of the Image

The heart of the Scophony system is the unit designated by "E." This is an oblong container filled with a clear, transparent liquid, having a window in either side. Light enters the window from the direction of "D," traverses the liquid, and emerges at the opposite window to continue on to "F." The container is sealed, preventing evaporation of the liquid. In the Rialto installation the liquid is xylol. Other fluids are substituted if the scanning rate is ever changed.

"E" also contains an oscillating crystal (quartz), on which the received signal is impressed after it has been amplified. Projectionists are familiar with the fact that certain crystals, including Rochelle Salts, generate electric current when subjected to mechanical vibration (as in the case of crystal phono pickups and crystal microphones) and conversely that such crystals subjected to alternating current vibrate mechanically, as in the case of crystal headphones or crystal loudspeakers.

Waves are Supersonic

Quartz is used for frequencies higher than those of ordinary sound, and the one in container "E" may vibrate several million times per second when the television a.c. is applied to it. These vibrations are imparted to the liquid.

It is important to realize clearly that the vibrations in the liquid are not electrical. The electrical portion of the system ends when the crystal has been made to vibrate. In short, the crystal is a kind of loudspeaker, setting up inaudible waves of compression and rarefaction in the liquid exactly as any loudspeaker creates sound waves in air. The waves in the liquid, of course, are not "sound" waves, being too high in frequency. They are "supersonic" waves, that is, waves of sound far beyond the pitch of human hearing. Like all sonic vibrations, however, they have a definite rate of propagation in any given medium.

The crystal is located at one end of "E," and the waves, originating at that end, pass across between the two window openings (only one window can be shown in the drawing, of course, the other faces "F") and rebound from the further end of "E."

The length of "E," and the choice of liquid, are such that waves reflected from the far end of "E" do not interfere with, but merge with, new waves coming from the crystal. When this system was brought from England to America, where scanning standards are different, instead of rebuilding "E" to a different length, the only change needed was to change liquids. In a different liquid the waves move at a different speed, just as ordinary sound moves at different speeds in air, in water, in steel, *etc.*

In operation, therefore, container "E"

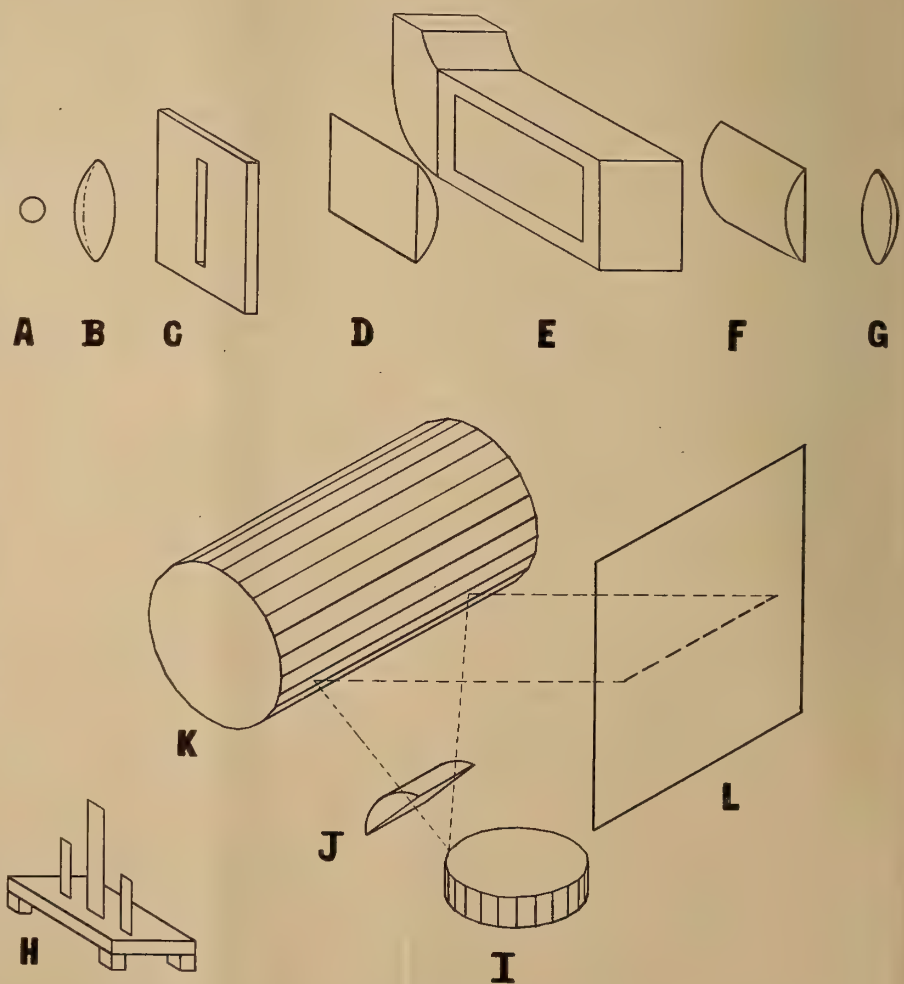

Diagram of optical train of Scophony theatre television system

is filled with waves of compressed or rarified liquid (perfectly transparent liquid). The frequency or spacing of these waves represents the scanning frequency; the intensity of compression or rarifaction reproduces the intensity of each pulse in the scanning signal, and therefore the intensity of illumination at one point in the original image.

The number of wave-crests between the windows of "E" at any given moment is equivalent to the number of points in one-half line of the image. In other words, the image is reproduced, not one point at a time, but one-half line, or 294 points, at a time.

Since the liquid is water-clear, it does not of course block light, whether compressed into high frequency waves or not. But it refracts light. Every transparent medium has an index of refraction, which depends on the nature and density of the medium. The liquid in "E," when set into vibration, presents points of high density (maximum compression) and of low density (maximum rarifaction). Where the televised signal is strong, the difference in refraction from point to point along the liquid, will be great; where the televised signal (and therefore the original illumination) is weak, the difference in refraction in "E" will be slight.

The Optical Train

Space limitations prohibit a full discussion of the optical details of the system. The drawings are intended only to convey the outline idea of the method used.

The light source, "A" in the drawing, is a standard projection arc. For the Rialto a hi-low type was selected. It operates at 110-125 amperes. Since current conversion equipment available in the projection room was only 50/50 amperes in capacity, a d.c. line was run in for the television arc. The trim uses 11 x 3/8" standard high-intensity carbons for both positive and negative, and one trim lasts long enough for any program at present contemplated, eliminating any need for changeover. Since there is no film to be changed, there is currently no need for more than one television projector.

"B" is a converging lens, the slit "C" and the cylindrical lens "D" cooperate to bar out stray light and to admit only the direct light from the crater to "E."

"H" is a septum or barrier. It intercepts or blocks out direct, unrefracted light coming from the lamphouse. When there are no waves in the liquid of "E," *no* light gets past "H." Everything beyond—to the right of—"H" remains dark permanently. "F" and "G" converge upon the center bar of "H" all the direct (unrefracted) light there is.

However, light which has been refracted by the waves in "E" does not come to quite the same focus, and does get past "H." Such light focuses on the mirrors of "I," which is a mirror-sided wheel, or mirror polygon, and which revolves.

Returning again to "E," the standing waves in "E" move across the window opening as one line after another is scanned. If they were projected to a screen they would drift across the screen as a series of waves of light. This effect is counteracted by the carefully synchronized rotation of "I" in the opposite direction, producing the precise scanning effect desired. That is, "I," in combination with the drift of waves through "E," provides the necessary *horizontal* scanning, a half-line at a time rather than a point at a time.

Vertical scanning is effected by "K," another mirror polygon. As a result of its rotation, successive lines are reflected to different levels of the theatre screen represented by "L," thus scanning the entire screen area.

The reader will note that this system of scanning is very different from the American systems of television. The makers assert it was planned for large-screen use from its inception, with complete disregard for the requirements of home television. The standard projection arc as the source of light, its makers say, was taken as the point of departure, and all other features were planned to make possible the use of that type of light source.

Non-optical portions of the system such as, for example, the television amplifiers, embody no important departures from the principles used by American manufacturers. Synchronization, in scanning is of course maintained by controlling the speed of rotation of the two mirror polygons, "I" and "K."

Cleaning Projection Room Wall Surfaces

INCREASING use of sound-absorbing material on the walls of projection rooms presents a new problem to projectionists who are concerned about the cleanliness and appearance of their working premises. Such materials are now often used for the upper portion of the projection room walls, beginning at a height of about five feet from the floor. They catch dust easily and become grimy in appearance. The theatre cleaning staff does not always know what to do about it.

One thing *not* to use is soap and water. These materials are usually sponge-like in structure (to increase their absorption of high-frequency sounds) and soap that has penetrated their pores is not easily flushed away. It may stay there, clogging the pores, reducing their sound absorbing ability, and itself providing a sticky surface that will rapidly catch more dust.

No cleansing agent should be used that will not evaporate completely. Alcohol-and-water is usually effective. However, since these materials vary greatly, any cleanser tried should first be used experimentally on a very small area in a remote corner, to make sure the material is not damaged. Alcohol plus ammonia water may also be tried in this way.

A More Energetic Agent

A mixture of benzine and carbon-tetrachloride, half and half, will prove useful for some types of obstinate stains, but is comparatively expensive.

For a more energetic agent, use a solution of water and tri-sodiom phosphate, but only after careful trial, and not too often. This agent will *not* evaporate completely. Crystals of the tri-sodium phosphate will remain in the pores of the material unless thoroughly flushed out. They are, however, crystals, as distinct from the gummy filling formed by residual soap.

Remember to try all these agents in advance on a very small, hidden part of the surface, to make certain the material is not injured.

Many acoustic surfaces can be painted, but not with just any ordinary paint. Most paints, including most "flat" paints, possess a certain amount of "gloss"—that is, give a more or less glossy finish. A paint that has even a small amount of gloss-producing ingredient will tend to bridge over the smaller pores of the material, impairing its acoustic properties.

Certain types of "acoustic" paints, made for resurfacing acoustic materials, are on the market. They are essentially truly "flat" paints. Paint purchased locally will serve if it is entirely "flat." The paint should preferably be sprayed on. If it is brushed on, it must be *very* thinly applied.

Avoid Excess Pigment

Most paints are made with a white pigment. When color is desired, the painter stirs in an additional, colored pigment. Too much pigment is undesirable. Therefore, either paint the surfaces white or try, if possible, to obtain a paint which contains no white but only pigment of the color desired.

Some acoustic surfaces, however, cannot stand any paint at all without loss of their acoustic properties. Before paint is applied, therefore, the manufacturer should be queried.

The foregoing remarks anent cleaning and painting apply equally to acoustic wall materials which may be used in the body of the auditorium or elsewhere about the theatre.

Screen Brightness, Theatre Design, Power Survey on S.M.P.E. Agenda

A REPORT OF THE THEATRE ENGINEERING COMMITTEE OF THE S. M. P. E.‡

MUCH of the work undertaken by the Sub-Committee on projection practice is at the present time incomplete, so that definite reports are not appropriate at this time. Work is continuing on the fourth revision of the Projection Room Plans, and it is hoped that a new report on this subject may be available in the near future.

The working committee on Tools, Tolerances, and Safety Factors has held a number of meetings and has made a number of tests on projection equipment.

The purpose of the Committee is to conduct a study of the motion picture projection mechanism from the servicing and operating viewpoint, and to determine the degree of wear at various points that may be tolerated with safety, and to devise or discover tools or gauges that may assist the projectionist in checking the degree of wear, and the corresponding departure of the mechanism from suitable operating conditions.

Several meetings of the working committee have been held and a number of tests have been conducted on projection equipment to determine the relation between the pressure of the film shoe and the spacing between the shoe and the surface of the film gate. This relation has been found to be linear, being approximately 0.0005 inch per gram of pressure.

Slight variations in the positions of the gates apparently make little noticeable difference in the picture jump. However, it is the intention to check this matter more accurately and to determine the minimum pressure required for steady operation. In addition, further tests will be made to determine the relation between shoe pressure and wear on the film perforations, and the relation between shoe pressure and the wearing of the sprocket teeth.

Theatre Power Survey

This report should be regarded as preliminary, and it is hoped that a comprehensive report will be available by the Fall of this year.

In the last report of the Committee was included a preliminary report of the working committee on Power Survey, in which it was pointed out that numerous data had been accumulated through questionnaires distributed among 1600 theatres of the country.

The purpose of these questionnaires was to secure a cross-section of data in relation to (1) the trend in current consumption for the various electrical units used in theatres throughout the country, (2) the total cost of electrical current, (3) energy consumption charges, and (4) the average proportions of power used for projection, air conditioning, lighting, etc. The previous report included a brief table of data pertaining to these factors. Insufficient time has been available to complete the tabulation, and it is hoped that a complete report will be available soon.

In the report of this Committee, presented at the Hollywood Convention last October, the growth of the Society's activities in the various phases of theatre engineering was described. It was pointed out also that many phases of theatre design, particularly from the projection viewpoint, had been considered by the Committee and had resulted in a number of recommended practices and procedures in general acceptance by the industry. Nevertheless, there were other phases that had not yet received adequate consideration — these phases referring more particularly to the theatre structure rather than to the process of projection.

Accordingly, by action of the Board of Governors of the S.M.P.E., on July 13, 1939, what was formerly known as the Projection Practice Committee was dissolved, and a new Committee was established, known as the Theatre Engineering Committee. This new committee originally functioned primarily through two sub-committees, namely the Sub-Committee on Projection Practice and the Sub-Committee on Theatre Design.

For a long time, the original Projection Practice Committee had been studying the question of picture brightness and its measurement. Some years ago, another Committee of the Society, known as the Screen Brightness Committee, had done considerable work on this subject and had published a noteworthy report and accompanying symposium on various features of screen brightness in the May and August, 1936, issues of the S.M.P.E. *Journal*. With the publication of this material, the Screen Brightness Committee became relatively inactive, since the information then at their command did not permit further constructive analysis.

In the interim, the study was coninued to some extent by the then existing Projection Practice Committee, and during the past year it became increasingly evident that further active work could be done on the subject. Accordingly, it was decided to establish a third sub-committee of the Theatre Engineering Committee, to be known as the Sub-Committee on Screen Brightness, which was to include in its scope, not only the actual specifications of screen brightness in theatres, but also the problem of devising appropriate means of measuring screen illumination and brightness, and of discovering or devising suitable meters for the purpose.

Since this new sub-committee has been functioning only a short time, its work

‡J. Soc. Mot. Pict. Eng., July, 1941.

Praise for the Craft

TO THE EDITOR OF I. P.:

I take this opportunity of expressing our sincere appreciation for your action in placing before the projectionists craft, through the medium of your recent editorial "The Craft's Splendid Job Loyalty," the statement of our credo to the effect that we would spare no effort to maintain the standards that we have set and striven to uphold during all these years.

Apropos the theme of your editorial, I should like to point out that during my recent visits to various gatherings of projectionists, at which was demonstrated the Simplex equipment, the reception accorded the writer and his associates was such as to deserve commendation and reflect great credit upon the craft. Never in my many years of experience with this company, speaking at public gatherings, have I received the degree of attention, courtesy and consideration that was granted to all of us at these craft get-togethers. Such consideration makes all of us here at IPC want to do more of this type of educational work.

The attitude of projectionists at these meetings made a fine impression on the representatives of this company, hence this note of appreciation.

ARTHUR E. MEYER,
General Sales Manager,
International Projector Corporation.

has not progressed to the point at which it can make definite recommendations to the industry. However, some progress has been made during the past few months, and the Theatre Engineering Committee is pleased to include in this report the first report of the new Sub-Committee on Screen Brightness.

Carbon Arc Terminology

It had been noted that some confusion existed in the motion picture industry with regard to the terms applied to various types of arc. In particular, specific definitions of the terms "high intensity" and "low intensity" were not available. The Projection Practice Committee, therefore, submits the following definitions of these terms:

The fundamental distinction between the high intensity and the low intensity carbon arcs is based upon the origin and character of radiation. The chief contributing factors and associated characteristics are composition of the carbons, current density, and brilliancy.

Low-Intensity Arcs

The *low-intensity* carbon arc is one in which the principal light source is incandescent solid carbon at or near its temperature of volatilization. In the case of the direct-current, low-intensity arc, as used for projection, this is the crater face of the positive carbon. The maximum brilliancy of this crater face is limited by the vaporizing temperature of carbon to a value of about 175 candles per square millimeter.

This crater brilliancy varies but little with changes in current within the usual operating range, but the crater area increases considerably with increasing current. Current density in the positive carbon for the familiar commercial lamps ranges from approximately 50 to 200 amperes per square inch.

High-Intensity Arcs

The *high-intensity* carbon arc, as used for projection, is one in which, in addition to the light from the incandescent crater surface, there is a significant amount of light originating in the gaseous region immediately in front of the carbon in an atmosphere containing flame materials (materials which become highly luminescent when volatilized in the arc stream). In the case of the direct-current, high-intensity arc this light comes from within and near the crater of the positive carbon.

The maximum brilliancy of the crater obtained in various types of direct-current, high-intensity carbon arcs used in common commercial lamps ranges from 350 to 1200 candles per square millimeter, with current densities in the positive carbon ranging from about 400 to well over 1000 amperes per square inch. Increase of current increases the crater area only slightly, but produces marked increase in brilliancy.

The Glossary compiled by Theatre Design Sub-Committee is intended for use for all those interested in motion picture theatre design. The Glossary will be submitted to the S.M.P.E. Standards Committee for possible inclusion in the General Glossary of Motion Picture Terms, which is under preparation by them, and will be called to the attention of other interested organizations or groups, including the American Institute of Architects and various architectural periodicals and trade papers.

Theatre Design Terminology

One of the chief benefits which it is hoped will be derived from this work will be to help in the writing of a uniform Code, which will govern the functional design of motion picture theatres. The present non-uniformity and confusion which exists in the large number of Building Codes both as to legal requirements and terminology has been brought to the attention of this committee through the study of a large number of existing Building Codes throughout the United States.

It is realized that it would be an almost imposible task to bring about a major change in the existing codes, particularly as regards uniformity. However, it is felt that this Committee can start with an attempt at standardization of terminology and the fixing of uniform viewing and hearing requirements in auditoria. This would enable such authorities as are contemplating changes in existing Codes or writing new Codes for motion picture theatre construction to be guided by the important visual and auditorium requirements in the theatre.

In addition to the Glossary, the Committee is first giving consideration to the lighting of theatre auditoria. It is recommended that the wall and ceiling surfaces within the spectators' field of vision, while viewing the picture, should appear to the spectator as a uniformly and uninterruptedly illuminated surface. Anything in the lighting that would tend to distract the viewer's attention from the screen picture should be avoided if possible.

It is very important for best results in the projection of colored pictures that the color of the lighting and wall surfaces be neutral. No departure from uniformity should be made unless the changes of intensity are gradual.

Auditorium Illumination

The Committee is not prepared to specify factual values of illumination, but it does stress, for the time being, uniformity of illumination and the elimination of isolated islands of light in dark surroundings or dark voids in areas of light.

This recommendation very definitely affects the style of architectural ornamentation and the design of the auditorium interior. The surfaces employed must be of such texture and color over large areas as will make possible this uniform illumination. Ornamental projections or cavities which cast shadows, and painted decorations in various colors and intensities are objectionable.

The fact must not be overlooked that the motion picture screen is a source of light and may cause undesirable and objectionable illumination of auditorium surfaces or ornaments, if the latter be improperly designed.

In connection with illumination, it is important that the arrangement of walls and doors of the outside lobby, the main lobby, the foyer, and so forth, be so arranged as to entrap the light coming from the street. If the line of traffic from the street to the auditorium is straight, his problem is difficult to solve unless extra sets of doors are used at intervals to block the light.

Screen Brightness

A more efficient method of an intimate form can be successfully evolved by so arranging doors and walls that the line of traffic follows a zee shape (Fig. 1). This is helpful also in eliminating objectionable drafts and in reducing the infiltration of street noises.

The recently appointed Sub-Committee

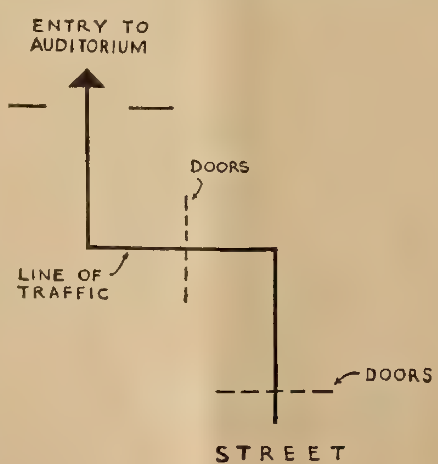

FIGURE 1

CHARLES E. CURLE DIES

Charles E. Curle, 40, for many years a member of Chattanooga, Tenn., Local 259, and for several years its secretary, died recently after a brief illness. Curle, known to many I. A. men through his attendance at conventions, was also head of the Curle Radio and Sound Service.

PAR BUYS SPARKS STOCK

Paramount Pictures has purchased outright the Sparks interests in the circuit of Florida theatres operated under that name. E. J. Sparks is resigning the presidency of the theatre circuit corporation, but will continue active service in an advisory and consultative capacity.

on Screen Brightness has held its first meeting.

Reflection characteristics of the usual screen materials and their response under given conditions are for the most part appreciated only in a general way, or take on only academic significance. Most people who have to do with the specification of screens and projectors and the other factors of theatre design and operation which affect the basic fundamentals of motion picture exhibition, have lacked the means to acquaint themselves with the values of brightness actually experienced by the audience. An appropriate correlation of the physical factors with the physiological and psychological elements involved has therefore been difficult.

It is axiomatic that progress on a technical problem is limited until one can deal with it quantitatively and do so conveniently. The first objective of the Sub-Committee, therefore, is to develop measurement procedures and facilities of such low cost and convenience that, on the one hand, specialists will be encouraged to amplify the information they now have, and on the other, that knowledge and experience of these matters may be widely diffused among those who control the conditions under which pictures are viewed.

Brightness meters presently available have limitations as to cost or convenience in use by others than specialists. Accordingly, as its first step, the Sub-Committee has formulated provisional specifications for instruments which would facilitate attainment of its objective, and is placing these before instrument manufacturers to determine the feasibility of having them made available.

Terms Used in Theatre Design

Aisle.—A passageway in a seating area.

Center aisle.—An aisle on the longitudinal axis of the theatre.

Wall aisle.—An aisle along one of the side walls of a theatre.

Intermediate aisle.—Any longitudinal aisle that is not a center aisle or wall aisle.

Cross-over.—A transverse aisle.

Balcony.—An area of seats, part or all of which overhangs another seating area.

Orchestra Floor.—The lowest seating area of a theatre.

Stadium.—An area of seats higher than and to the rear of the standee rail or partition, accessible directly from the standee space.

Stepped Platform Seating.—Stepped platforms, one above the other upon which seats are placed. The amount of rise from one platform to another being determined by the sight clearance factor.

Uniformly Pitched Auditorium Floor—A floor having an equal rise or fall for each row of seats.

Variably-Pitched Auditorium Floor.—A floor incline having a changing pitch for every row, or groups of rows, of seats to ob-

tain proper clearance of the sight lines.

Auditorium Bowl Floor.—A floor incline for curved rows of seating in which the change of pitch takes place by keeping all of the seats of each respective row on one level.

Concentric Arcuated Seating Rows.—Seats placed in curved rows, the radii of which increase for each row, placed further from the auditorium front wall.

Down Pitch Auditorium Floor.—A floor which pitches in part or whole downward toward the auditorium front wall to provide sight line clearances.

Reverse Pitch Auditorium Floor.—A floor which pitches upward in part or whole toward the auditorium front wall to provide raised seating levels located near to a motion picture screen to bring these seating levels as close to the screen level as possible.

Combination Pitch Auditorium Floor.—A floor which pitches downward toward and then upward toward the front wall of the auditorium.

Auditorium Lighting.—Any auditorium lighting in use when the motion picture show is not in progress.

Projection Period Lighting.—Any lighting of the auditorium that may be necessary or desirable during the projection of the motion picture.

Transition Lighting.—The gradation of illumination from outdoors to the auditorium.

Light Trap.—An arrangement of wall and doors designed to exclude undesired light from the auditorium.

Re-reflected Screen Light.—Light reflected from the screen and re-reflected from any other surface in the auditorium.

Atmospheric Light Reflection.—Reflection of light by particles in the atmosphere of the auditorium.

Auditorium.—The space in a theatre from any point of which the performance may be viewed.

Standee Partition (or Rail).—A partition (or rail) separating a last row of seats from a cross-over.

Standee Space.—A space in a theatre in which patrons are permitted by law to stand.

Lobby.—The space between the first and second sets of doors of a theatre.

Foyer.—A gathering place between the auditorium and the lobby.

Outside Lobby.—A partially enclosed space in front of the first set of entrance doors. (Sometimes called "Vestibule".)

Soffit.—Generally used to refer to the ceiling under the balcony.

Right Side (of auditorium).—The right-hand, looking toward the screen.

Left Side (of auditorium).—The left-hand side, looking toward the screen.

Mezzanine. — An intermediate level between seating levels.

Auditorium Front Wall.—False wall or structural wall at the front of the auditorium on the audience side of the screen.

Exit Court.—A space for egress open to the sky.

Exit Passage.—A space for egress entirely enclosed.

Auditorium Rear Wall.—The wall at the opposite end of the auditorium from the screen.

(*Continued, foot of next page*)

Tips on Some Projection Room Tools

Diagonals or cutting pliers should show no light between the cutting edges when closed and held up to the light. This is especially true at the outer ends of the cutting edges. Remembers this when buying diagonals. Examine the ones you have; if they show light between cutting edges, get new ones.

Keep the tip of the soldering iron filed smooth. Pits and depressions develop with use. File them away and re-tin the tip. Pits and depressions catch molten solder; prevent it from flowing freely. If the tip is kept smooth it will pick up a "bead" of solder, carry it without dropping it, and deposit it on any connection to which the tip is touched. A pitted, corroded soldering iron tip holds on to the solder. Then it is necessary to use two hands, applying the soldering iron with one and the solder with the other. This makes work more difficult. It may result in slopping too much solder on the joint, and the excess may drop off and form a short-circuit somewhere below.

Replace soldering iron tips often. As they are filed, to keep them smooth, they naturally become shorter. In some emergency it will be found that the tip is too short to reach into a narrow corner. Attempts to finish the work with a short soldering tip may result in overheating neighboring parts, loosening neighboring connections, or other trouble. Unscrew the tip and insert a new one as soon as filing has shortened it as much as 25%.

Do not file a hot tip. The hot solder will fill the teeth of the file and prove very difficult to remove. You are likely to end by throwing away a once good file. File the tip before heating. Avoid getting soldering paste into the teeth of the file.

When magnetizing a screwdriver or other blade, wrap only one turn of wire around the steel. Winding on a double turn of wire, forward and back, produces two fields which tend to neutralize each other, and reduces, rather than increases, the magnetization.

A screwdriver with an excessively sharp edge, even though magnetized, will not hold a screw properly. The edge being too thin for the slot in the screw will permit the screw to throw sidewise.

Storage of Meters

When putting away any type of multimeter after use, be sure to set it at the highest reading. That is, for example, in the case of a voltmeter having several ranges, put it away connected for the highest range. If it is used by yourself or someone else hurriedly, in an emergency, without examination of its connections, it will not be burnt out. If it is put away connected, say, for the ten-volt scale, and later used hastily for 100 volts, it will be destroyed.

The same principle applies to multireading ammeters. Where there is an ohmmeter in the instrument, never put it away set for reading ohms. If the leads should become crossed by accident while it is in the parts cabinet, the meter will read short circuit until its internal battery is destroyed.

Examine the dry cells in ohmmeters at frequent intervals. When the zinc case wears through, the white, corrosive sal ammoniac, which is the activating paste, oozes out and corrodes almost anything it touches. Check and change ohmmeter dry cells often enough to make sure the interior of the meter will never become corroded through keeping a dry cell in service too long.

Improvisation of Fuses

While improvising fuses is very poor practice, emergencies do arise, therefore there are submitted here some data on copper wire by means of which fuses can be improvised with the help of a wire gauge.

Remember that the data that follow are *approximate* only (Table A). It is not current that melts the fuse, but heat. Now, the temperature that will be generated by a given current flowing through a given conductor depends somewhat on factors of heat dissipation. Remembering this, it is easily understood that even factory-made fuses can be depended on to perform only approximately according to their ratings. This is even more true where fusing is improvised.

The figures in Table A, of course, have nothing to do with the "carrying capacity" of wires, which is based on ability to carry current without appreciable temperature rise. These figures represent temperature rise great enough to fuse the wire.

TABLE A

Wire Gauge	*Approx. Fusing Current in Amperes*
20	60
21	45
22	40
23	35
24	30
25	25
26	20
27	17.5
28	15
30	10
32	8.3
33	6.6
34	5
35	4
37	3
38	2.5
39	2
41	1.5
43	1

TOPICS ON S.M.P.E. AGENDA

(*Continued from preceding page*)

Auditorium Side Walls.—Walls other than the front or rear walls of the auditorium.

Proscenium Opening. — The opening in the auditorium front wall through which the screen is viewed.

Rear Screen Space.—The space on the side of the screen away from the audience.

Traffic Control.—Physical or suggestive. Any device (architectural lighting or decoration, signs, door controls, barriers, etc.) used to control the direction of the passage of people in the public spaces of the theatre structure.

Vomitory.—A walled in passage used for circulation to seating areas usually cut through a raised inclined seating level.

Balcony or Stadium Fascia.—The surface facing the motion picture screen which forms part of the protective wall and rail in front of a balcony or stadium.

800-Mile Tele Experimental Circuit via Coaxial

Following completion recently of tests preliminary to the multi-channel telephone use of a 200-mile length of coaxial cable between Stevens Point, Wis., and Minneapolis, engineers of Bell Telephone Laboratories, by looping back the coaxial conductors, formed an experimental circuit of 800 miles for the transmission of television signals.

Scenes televised in the Minneapolis Telephone Building were transmitted over this looped-back circuit and compared with direct transmission when only a few feet of wire connected the camera and the receiving tube. The difference was imperceptible to most observers although the Laboratory engineers could detect impairments somewhat greater than were observable in the earlier test of 190 miles over the New York-Philadelphia coaxial.

Transmission was by carrier with an effective band width of 2¾ megacycles. This transmission, over a total length more than four times as long as that previously obtained over the New York-Philadelphia coaxial, marks a further but by no means a final experiment in the development of coaxial-cable systems for television transmission.

HONOR HERMAN A. DeVRY

The late Herman A. DeVry, pioneer picture equipment inventor and manufacturer, and former president of the DeVry Corp., has been awarded a posthumous degree of Doctor of Science by Lincoln Memorial University, Harrogate, Tenn., in recognition of his distinguished service in the field of science and his many contributions to the art of visual education.

Some Current Changeover Practices

AN OLD-TIME projectionist friend of ours, who must be nameless, tells us he has had no less than four aperture fires in one day because of tin foil, cemented onto film to operate home-made reel alarms. The foil, placed along the inner side of the film, not the side sound-track side, scrapes off at the intermittent sprocket, our friend says, pushing the shoe back. The whole strain of moving the film therefore falls on the sprocket holes at the sound track side, which tear. The film stops moving, and catches fire.

And, believe it or not, such prints go through the exchanges with foil cemented to them, and the exchanges do not remove it.

The writer knows of no less than three projection rooms, none of them a million miles from Times Square, N. Y. City, where tin foil is regularly added to prints for this purpose. The boys find that cigarette wrappings are most useful. A long, thin strip is cut, folded along the edge of the film and secured with film cement. Perhaps a better glue could be found which would hold the foil permanently to the film, and prevent the troubles that arise when it peels off.

To provide bell-ringing contacts for this home-made changeover alarm, one projection room crew went so far as to drill and tap the main frame of the soundhead, and mount an insulated roller therein. In another, the crew insulated the film chute between the sound head and the lower magazine. Bell-ringing transformers provided the operating current. In one projection room a flashing light as well as a buzzer was installed.

Use Three Foil Strips

In general, three separate strips of foil were added to each reel, one to signal lighting the other arc, the second as warning to start the other motor, and the third for actual changeover.

Reports of other dodges, anent "improvement" of the visual changeover cues, continue to come in as usual. Mutilation of the standard changeover marks, or enlargement of those marks with grease-pencil or otherwise, to make them visible, have become almost routine. Complaints of mutilated reels, from which cue marks have been removed in patching while the exchange neglected to replace them, also continue to come in in normal volume.

As usual, the craft will be blamed.

Men who have the energy and ingenuity to drill and tap a soundhead main frame for the purpose of installing a cue-alarm roller cannot be entirely to blame, it must be evident. At least, they have ingenuity and energy, a good grasp of their business, and willingness to work to get the result they want. One may be pardoned for wondering if existing changeover cues adequately serve the needs of the craft.

Back in the old days, before sound pictures, the film carried only visual indicia, and naturally changeover cues had to be put on in visual form. In those days, also, standards of projection were less critical, and if a man missed a cue mark and produced a sloppy changeover, less was said about it. Today, when so many managers regard the least flaw in a changeover as evidence of incompetence upstairs, and say plenty about it, the boys seem to feel driven to add changeover cues of their own—even at the cost of four aperture fires in one day!

Audible Changeover Cues?

How about audible changeover cues, now that every film carries audible indicia? The writer has in mind, for example, a pure tone, to be added to the sound track, which could be kept out of the screen loudspeakers by an electrical tone filter, but emphasized in the monitor speaker by means of a band-pass filter adjusted to that tone. Such a system would remove all cue marks from the eyes of the audience, yet carry them unmistakably into the ears of the projection crew. It would permanently end grease-pencil marks, tin foil, punch marks and other makeshifts, and would certainly leave no further excuse for sloppy changeovers.

There would be complications, of course. The location of each such audible cue in the sound track would have to be marked in the sprocket hole region by some visible sign; the exchanges would have to look for that sign in every reel and make sure to patch the cue back in if it were found patched out.

Reel-end alarms of either the contact or the centrifugal type might also be given more consideration than they have had to date, particularly by those managers who consider a poor changeover an unpardonable crime, but throw up their hands in holy horror when the cost of a reel-end alarm is mentioned.

Wailing Increases as B.O. Slump Deepens

LOUD and long wailing relative to the present sad state of the motion picture theatre box office continued to emanate from exhibition circles during the past month, with the harrassed distributors and producers doing their best to combat the charge that the slump requires the correction of three shortcomings on their part, i. e., poor-quality product, excessive production costs, and exorbitant rental demands.

The most significant development of the month in connection with widespread demands for changes in the industry's merchandising policies, however, was the concerted effort of various potent exhibitor organizations to abolish double-feature bills and to eliminate all give-aways and games of chance in theatres. No less than three major exhibitor units —the national MPTOA, the I.T.O.A. of N. Y. City, and the Allied unit in Chicago — are advocating strenuously the abolition of dual bills—the one proviso being that the major affiliated circuits do likewise. No answer from the "majors" on the proviso.

Appended hereto are various excerpts from statements by various industry personages which indicate the current trends of thought on the aforementioned topics. First, from H. M. Richey, exhibitor-contact man for M-G-M:

More Leisure, More Diversions

"To comprehend why too many potential patrons are looking elsewhere for their recreation it is necessary to go back a decade or so.

"When labor, in order to spread jobs over a greater number of people, was successful in shortening the working day from 50 hours a week to 45 and then to 40 and in some instances 35, the whole American public became more recreation-conscious for the simple reason that they had more time on their hands—more leisure hours to fill, and where before they worked longer hours and motion pictures were the only amusement they could find time for at hours that were convenient and not too tiring, now they have plenty of time to look for and embrace many sports and recreations which before were impossible.

"The five-day week, offering opportunities for a long week-end doing other things than attending movies—golf, hobbies, more bridge because Mr. Wage Earner has more time, bowling—all of these sports have found a new revitalization from a public who has become more recreation-conscious.

"While this change was taking place the average theater continued its role of a more or less public utility—there to be used when desirable, flaming up once in a while when a big picture stuck its thumb in the public's eye and demanded to be noticed, but carrying on day after day much in the same manner it had for years. I say this not as criticism, but as an analysis of the position many theater owners find themselves in today."

From the distinguished Mary Pickford in an address to the MPTOA convention:

Why She Opposes Dual Bills

"I am convinced that the falling off in attendance is not due to any lack of quality in present-day productions. The average 'B' picture of today is so vastly superior to the majority of 'A' pictures of 12 or 15 years ago that there is no comparison.

"I am firmly opposed to double-features for three reasons:

"First—I have to sit through a picture I

don't want to see in order to see a picture I do want to see.

"Secondly—If two pictures happen to be good, I have used up all my energy in enjoying first feature and am too tired to enjoy the second.

"Lastly—A double feature keeps me up too late."

Miss Pickford said she is convinced these are the exact reactions of nine out of ten adults. She asserted some of her exhibitor friends had told her children demand double features, but she posed the question whether theater owners can afford to cater to the whims of children who in the majority of cases during their school terms, only attend film shows on Saturday afternoons. Miss Pickford said no producer would risk putting important money into a production for the exclusive consumption of juvenile audiences.

Giveaways, Games the Bunk

"It is to be hoped that exhibitors in every corner of the country, on one and the same day, will abandon this vicious practice and at the same time desist from Bank Nights, shelling out dishes, vegetables, and all means of bribing the people to come into the theater. Let us revalue our great industry as it so richly deserves and stop selling it short."

Miss Pickford suggested that some organized method to determine what the public likes and does not like should be established.

From movie columnist Donald Kirkley of the *Baltimore Sun*:

"For several weeks the film trade papers have been filled with shrieks of anguish, the result of a totally unexpected slump in business. . . . So serious is the situation that exhibitors have been holding councils of war and racking their minds to get at the causes for the phenomenon. All sorts of fantastic reasons have been advanced, but nobody seems willing to face the most obvious cause, namely, the increasing poor quality of the pictures over a period of two years.

Should Poll Stay-at-Homes

"Why the film men should look beyond the sort of pictures they have been offering, is not obvious to a layman. They fail to mention the deadly double feature, with its insatiable demand for quickies and the cheapening of the product as a whole.

"They are conducting polls of moviegoers in an effort to find out what is wrong; the ones who should be polled are the people who have stopped going to the movies."

Abraham Myers, general counsel for Allied T. O. of A., enters the list *via* a bulletin which cites this delectable item anent the display ad copy on the "amusement" page of the Medford, Wisc., *Star-News*:

"One movie theater in Medford; one movie theater in the nearby town of Phillips; one traveling carnival; one roller skating rink; 17 taverns and resorts, offering one fish fry, two chicken fries, on free birthday dance, one free married folks' dance, four free wedding dances, eight name bands including Orrin Tucker with Bonnie Baker, and five free 'talkie movies' shows.

"The most serious part of the competition in Medford consists of the many free 'talkie movies.' We hope this page will be studied by those general sales managers who have given the run-around to Allied committees appointed to protest against the releasing of films for non-theatricals.

"Of course, all will deny that they license films for non-theatricals but the fact is they permit their copyrighted films to be reduced to 16 mm. and then to pass out of their control so that they can be used in giving free talkie movies in competition with established theatres."

Meanwhile, M-G-M will send two studio representatives on a nationwide canvass of 90 large city newspapers in an effort to find out what the public really wants in the way of film fare. Barney Balaban, Paramount prexy, stated that dual bills can be eliminated only by a consistent flow of good pictures, "with the near future an opportune time for such a move." Certain exhibitor organizations want the producers to contribute $500,000 for a back-to-the-movies ad campaign. Still others blame the numerous appearances of picture people on the radio.

A Unique Film Scanner for Testing Television Transmission Images

By *W. A. KNOOP*
MEMBER OF THE TECHNICAL STAFF
BELL TELEPHONE LABORATORIES

JUST as program broadcasting requires extensive networks of cable circuits to connect studios and radio transmitters, so television broadcasting will need similar cable connections for its most effective growth. To a limited extent the Bell System has already supplied such facilities on an experimental basis.

The development and testing of these facilities is complicated both by the very wide band of frequencies that must be transmitted and by the varied requirements for television transmission. In some respects these are much more severe than those placed on multi-channel telephone circuits, even when the total band width is the same.

Scanning the Film Frames

A circuit entirely satisfactory for high-quality telephone transmission might not be satisfactory for television transmission because the response of the eye is not at all like that of the ear to certain types of distortion. The most satisfactory way to test television circuits, therefore, is to transmit television signals over them, and to judge the results visually.

In making such tests it is desirable to transmit the same scene or series of scenes over the cable again and again. For this reason a motion-picture film is the best source of the transmitted material.

With this method the picture frames on the films are scanned successively by some form of television scanner, and the resulting television signals, suitably amplified, are transmitted over the circuit. Each frame is scanned in a series of lines one above another, and thus there is a vertical as well as a horizontal component of the scanning.

In using film, it seemed desirable to let the motion of the film provide the vertical component, and thus to simplify the scanning equipment. Since the ordinary motion-picture projector moves the film intermittently, a suitable transmitter for these tests was developed by modifying a Western Electric film recorder to secure steady motion of the film and the other features that were required.

The complete machine is shown in Fig. 1. At the extreme left is the scanning equipment, and the rectangular case next to the right carries the projection lamp. Light from this lamp passes through a lens in one side of the case and then through an opening in the film case adjacent to it, where it is refracted by a right-angle prism to pass through the film and into the scanning equipment.

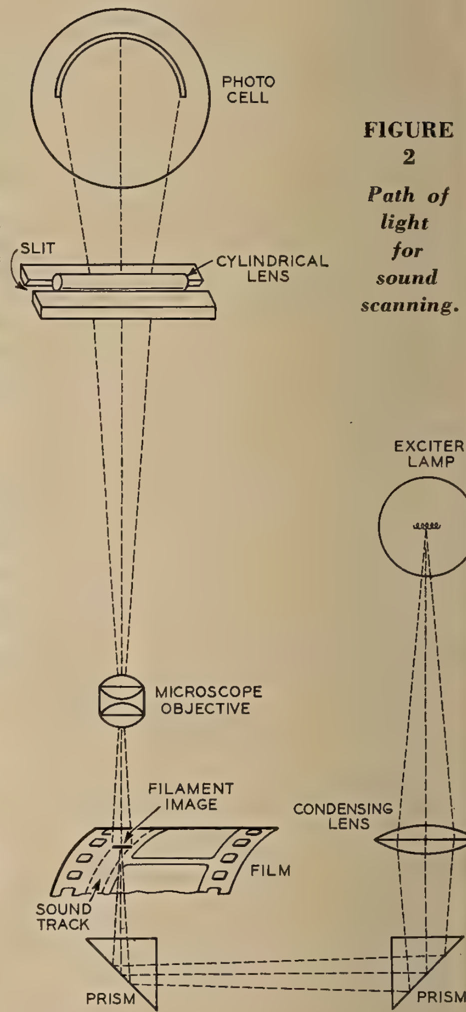

FIGURE 2

Path of light for sound scanning.

Just above the left end of the film cabinet is the equipment for sound pick-up. It includes a photo-electric cell, lenses, and certain miscellaneous equipment. The film supply reel is at the upper center, and the film take-up reel is below it and just beneath the film compartment. At the right is the motor that drives the film. The lamp housing is mounted on a hinged bracket, and may be swung out to give access to the film cabinet.

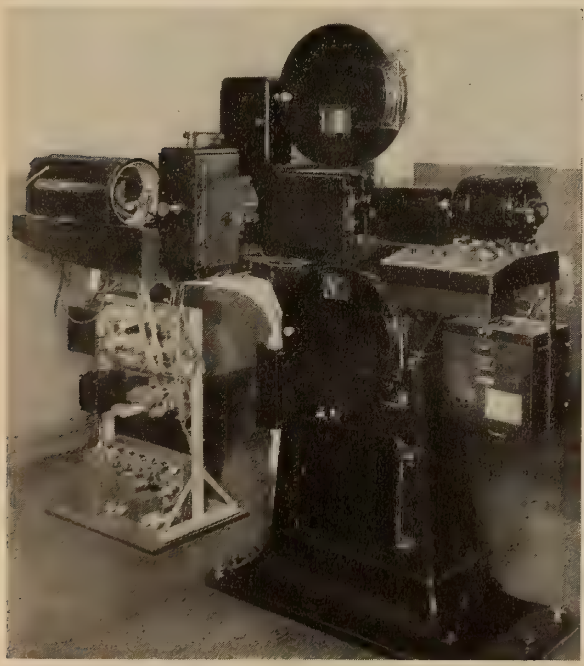

FIGURE 1

The complete film scanning machine. At the extreme left is the scanning equipment, and the rectangular case next to the right carries the projection lamp.

A close-up of the apparatus with the various doors open is shown in Fig. 3. The film passes down from the film magazine, over the top of a film sprocket that pulls the film from the magazine, thence

around the main sprocket at the left, back against the bottom of the first sprocket, and down to the take-up reel.

The rectangular prism is within the main sprocket at the left center, whence the light passes through the film and is formed into an image of the film on the cathode of the dissector tube which is used for scanning.

The Light Path

The sound gate is at the top of the main sprocket, whence the light passes through the sound track on the film, through an optical system, and to the photo-electric cell in the cabinet above. Light for the sound pick-up comes from a rear compartment of the photo-electric cell cabinet, down through a prism, and thence horizontally through the semi-circular bridge just above the main sprocket, and then through another prism up through the film. The path of this light is shown in Fig. 2.

The rim of the main sprocket overhangs its shaft to provide space for the prism and to enable light to be transmitted through the film for television scanning. To meet this latter requirement, the rim is a lattice, with its outer edge supported by crossbars spaced so as to fall between the frames on the film. Light for the sound pick-up does not pass through the rim of the sprocket, and thus there is no interruption of the sound beam.

An ordinary motion picture film is projected at the rate of 24 frames per second; while present television standards call for the equivalent of 30 frames per second. Moreover, the picture is scanned in 441 lines interlaced. This means that each frame is scanned twice, each scanning passing over alternate lines: on the first scanning the odd-numbered lines will be covered, and on the second, the even-numbered lines.

Since the film is moving steadily, this interlaced scanning could readily be accomplished by printing each frame twice. On the first of each pair of frames, the odd-numbered lines would be scanned, and on the second frame. the even-numbered lines. Under these, conditions, if the film were moved at the rate of 48 frames per second, the picture would be at the rate of 24 frames per second.

Printing, Running Technique

By printing every other frame three times instead of twice, and running the film at the rate of 60 per second, the desired 30-per-second frame speed is secured. A specially printed film is thus required for the scanner, but since only a small number of representative subjects is required, the additional cost of the film is more than offset by the resulting simplicity of the apparatus and the ease of maintenance.

Although the continuous motion of the film avoids the necessity of vertical scanning so far as the picture itself is concerned, a small amount of vertical scanning is used because the distance between frames on a motion-picture film is greater than the equivalent "blanking" time between television images. The difference is about seven per cent of the frame time or about 30 lines of the picture.

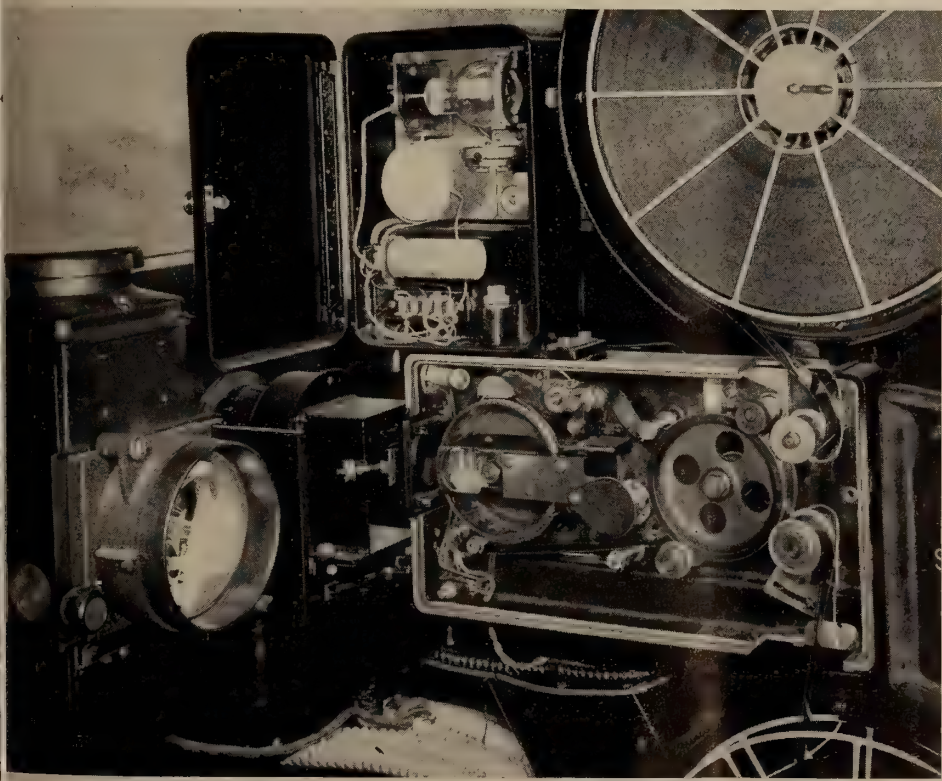

FIGURE 3. *Close-up of film chamber with sound pick-up cabinet above.*

To avoid this loss, about eight per cent of vertical scanning is supplied. The scanning thus follows the image as the film moves down so that the image is scanned about eight per cent longer than it otherwise would be.

The complete film transmitter consists of a number of bays of equipment, including a monitoring bay, as well as the film-scanning machine itself. It is installed in the Graybar-Varick Laboratories, and has proved very useful in studies made of the three-megacycle television channel between New York and Philadelphia.

16mm. 'Menace' Chief Topic at N.E. District Meet

Principal topic on the agenda of the recent Third New England District Convention held in Springfield, Mass., was pending legislation permitting the showing of movies in so-called halls in villages and towns without the restrictions usually imposed on showings in larger communities.

Extended discussions were also held on the showing of movies in cafes. It was disclosed that a Boston firm sells 16 mm. projectors on the basis that one can "earn a good night's pay through showings in cafes and dance halls, doing two or three a night."

In Worcester, the union halted the operations with help from the license board, because state regulations forbade serving of liquor in semi-darkness and that the dance halls were too crowded for safety. When the Holyoke Arena started showing free films the local license board refused to act in the matter. The union hired a lawyer, and the State ABC commissioner ruled against the Arena.

Louis Krouse, Int. Gen. Sec.-Treas., declared that 16 mm. showings were a "decided menace" and said that control thereover was a job for each local union in its own territory. F. W. Newcomb was re-elected secretary of the District.

Power Crisis in S.E. States

Following closely on the heels of a power-rationing move in Georgia, which called for the saving of at least 33⅓% of power consumption and which hit very hard the State's 331 movie theatres, came a declaration by the Federal Power Commission of the existence of a power emergency in the entire Southeastern territory and the invoking of emergency moves provided by the Federal Power Act.

The initial order under the emergency calls for the immediate curtailment of street and of ornamental lighting of every description. Naturally, theatres will be severely affected. The emergency has been declared for Virginia, Alabama, Georgia, Mississippi, Florida, North and South Carolina. A nine-months' drought is the principal cause of the emergency.

L.U. 150 Proposes Changes in S.R.P.

HEREWITH are reproductions of a questionnaire, and accompanying letter, sent out to all I. A. projectionist units by Local Union 150, which, by virtue of its close proximity to the studios in Los Angeles and the fact that many of its members are engaged in production work, evidently feels that it is best situated to effect those changes in the Standard Release print which it feels will be beneficial to projectionists everywhere.

Even a casual reading of the form reveals that not a few of the proposed changes have been topics for extended discussion at projectionist gatherings for many years past, the most notable contributions to the subject having been made by Thad Barrows, president of Boston Local 182, and published from time to time in these pages.

Prominent among the old bugaboos that have popped up again in this questionnaire are those relating to relatively short film footage on the last reel of a feature release, the inclusion of sound at the extreme end of reels, proper identification of reels, and the cutting out of changeover cues by projectionists on early runs. Conspicuous by its absence from the proposals is any reference to the question of varying print density, which item has long been an irritant to those interested in good projection.

Individual Opinion Wanted

Thus far distribution of the questionnaire form has been confined to the "O" and "M" locals of the I. A. Its reproduction here is intended to provide the individual projectionist with the opportunity of expressing his views thereon. In this connection I. P. will be glad to receive filled-in forms from individual projectionists for forwarding to Local 150 officials.

While it is eminently desirable that projectionists give these proposals their closest attention and that discussion thereon be as extended as possible, it seems best that judgment on the proposed changes be held in abeyance, particularly in these columns, until sufficient data has been returned to Local 150 officials to estimate with some degree of correctness the judgment of the craft as a whole. Also, it would undoubtedly be beneficial to have on record the reaction of the studios to whatever changes are finally suggested.

Thus far there has been no indication of the attitude of the Academy of M. P. Arts & Sciences to the proposed changes. The Academy played a leading role in setting up the original S. R. P. specifications, and such changes as have been made in the specs since their inception have gone through the same channel. To date the Academy has been very much interested in and responsive to the opinion of the projectionist craft on matters affecting theatre reproduction, and it seems likely that its Research Council would go along with any reasonable changes that reflected craft opinion as a whole.

I. P. urges that all projectionists make a real effort to register their opinions on these proposed changes, not only because of their bearing on the daily work routine, but also as an indication of the responsiveness of the craft to technical developments relating to the advancement of the art.

L. U. 150 Letter Outlining Proposed Changes in S. R. P.

MOVING PICTURE PROJECTIONISTS
LOCAL 150, I. A. T. S. E.
1489 W. WASHINGTON BLVD.
LOS ANGELES, CALIF.

4 0

Dear Sirs and Brothers:

Los Angeles Local 150 I.A.T.S.E., through its Film Committee, is making a study of the present film standards. It is our contention that a few changes could be made which would ultimately be highly beneficial to the projectionist in his work. We feel that in order to expedite these changes, it would bear far greater weight, could the issue be presented to the Motion Picture Producers from a National rather than a Local viewpoint. In order to acquaint you with the articles to receive consideration, we are presenting the following items:

1. THE FOOTAGE OF REELS IN A FEATURE PICTURE.

We have found on numerous occasions where the entire picture can be comfortably put on four, five or six reels, but the product has been shipped out on an extra reel, making the last reels between 350 to 550 feet, which might easily have been divided amongst the preceding reels. We feel that this practise should be stopped and can be, if brought to the attention of the Producers.

2. IDENTIFICATION OF REELS.

We are attempting to have the title of the picture placed on each numbered frame of the run-down leader. By so doing, we shall have the name of the picture at each footage number that the projectionist uses in threading his machines. As a great deal of tagging of prints is now prevalent in our jurisdiction, we think that this change will be of value to the projectionist and will minimize the hazard of threading the wrong reel.

3. SOUND AT CHANGE-OVERS.

Recently there have been many productions where conversation on the film has been carried right up to the last frame of the outgoing reel and starts on the first frame of the incoming reels when change-overs are made. In some instances it has even been accomplished in full screen close-ups. We feel that this also can be controlled and rectified. With several hundred feet to select for change-overs, it does seem quite obvious that more appropriate scenes could be found to end reels.

4. THE ELIMINATION OF CHANGE-OVER CUES.

By the time a print has been run several times, somewhere along the line the change-over cues are cut out by some projectionists. This throws an additional burden on all other projectionists who must subsequently run the print. It is our desire to bring this matter to the attention of our own membership and take steps to elimnate this practise.

In addition to the above mentioned items, we are striving to have identification of cartoons and other short subjects placed in the run-down leaders.

We would like to have the footage of each reel placed somewhere in the leader.

To call to the attention of the Producers the various distances that the motor and change-over cues have been placed and try to make them adhere to the Academy Release Print Standard Specifications.

To try to stop the practise of placing fade-outs, fade-ins and dissolves between motor cues and change-over cues.

To have larger printing in the identification leaders so that the name of the picture can be more plainly seen on each reel and many more such irregularities as may be brought to our notice during this survey.

We believe that these and other changes can be accomplished as they entail little or no cost to the industry. The importance of this venture is the necessity of agreeing as to the changes we deem essential and the united desire of all projectionists to sanction such changes as may tend to benefit our craft.

The Committee now working on these problems would like to get the opinion of all projectionists in regard to that portion of the run-down leader which informs them of the fader settings prescribed by the Studio. Do you find these fader instructions of any value? Or could these fader instructions be eliminated without seriously affecting your work?

We hope that this matter will be taken up wth your membership and thoroughly discussed. We shall eagerly await your early response and will welcome any and all suggestions and advice along the lines above mentioned.

Enclosed you will find a questionaire which has been sent to all our members to assist in this work.

Trusting to hear from you at your earliest convenience, I am,

Fraternally yours,
M. J. Sands,
Secretary-Treasurer.

Canadian Locals Subscribe to Victory Loan Bonds

To the Editor of I. P.:

The appended copy of a letter outlines the war effort of I. A. local unions throughout Eastern Canada:

"Chairman, Victory Loan,
"Toronto, Ont., Canada.

"Dear Sir: The Toronto Motion Picture Projectionist Union, I.A.T.S.E., an organization with a majority of World War I veterans in its ranks, desire to aid in every way possible in this struggle for democracy and freedom.

"These men, who have individually contributed most generously to the war effort, have now decided unanimously to assess themselves the sum of five dollars each, and thus raise the sum of one thousand dollars, with which to purchase a Victory Bond. With the thought that this action may be an incentive to others to boost the Victory Loan, I am passing this idea on to you.

Arthur Milligan,
Local Union, 173, I.A.T.S.E.,
Toronto, Ont., Canada."

'Hypoing' an Outmoded 16mm. Projector to Get Fine Results Over A Long Period

The accompanying article, sent to I. P. by a British friend, relates how the evacuation of a boys' school from London to the country permitted the taking along of only a somewhat outmoded 16 mm. projector with which to carry on educational and entertainment activities. The ingenious methods employed to "hop up" this equipment so that it gave remarkably good results over a long period of time should prove of considerable interest to projectionists everywhere.

By *D. BATEMAN*

SOME twenty odd alterations were made to the equipment, as experience has shown points where improvement is possible, and now we regularly give two 2½-hour shows weekly, showing even 2-hour films non-stop and with the usual professional devices such as curtains opening on the main titles, and superimposed colour effects, *etc.*

Our improvements can be classified as:

(1) Reducing the chance of a stoppage.

(2) Improving the sound quality.

(3) Producing a more finished projection.

The chief alteration under item (1) was to enable the single machine to run non-stop for 2 hours. The largest reel available lasts 45 minutes. We therefore made a plywood reel with solid oak centre and metal plates with square holes in. which takes over 4,000 ft. of film.

To mount this the front spool arm was removed from the projector case and mounted on a wooden bridge built across a large baseboard some 5 feet long by 18 inches wide. The projector and rear spool support are also mounted on this baseboard and fixed in true alignment.

A 4,000-ft. Take-up

To wind up film on a 4,000 ft. reel is impracticable, so 1,600-ft. rear spools are used. This means changing the rear spool during projection. This is easily accomplished by breaking a join at the end of 1,600 ft. and allowing the film to sink (through an aperture cut in the base of the projector case) into a bin below the shelf.

By the time an empty spool has been put on and threaded, some 20-30 feet of film have accumulated and it is only a matter of a few seconds by hand braking the rear spool to let it pick up this portion of film and take up the normal winding action. Similarly, should the rear spool wind up loosely owing to a slack clutch, it can be changed at the next film join without stopping the machine.

Cure for Lamp Failures

The next most frequent source of stoppage is due to burnt-out main lamps. To lengthen their life we have improved the ventilation (*a*) by removing the lamp house top and fitting a wide metal tubular chimney which both offers less air resistance and conducts the hot air outside the projector case.

Here a large plywood chimney some 8 inches square conducts the hot air to the roof of the projection booth where it flows up a chimney a foot square, in which is a high-speed electric fan. The cold air entering the projector case from below through the hole in the base is cleaned as it enters the projection booth by passing through a double sheet of thin muslin soaked in car oil.

We find it necessary to rehearse portions of films, and in order to avoid wasting the main lamp life a fixed resistance has been made cutting down the voltage on the lamp from 110 volts to 60 volts. This gives a dim picture at rehearsals, and is short-circuited by a switch for proper projection.

Owing to the large variations of voltage in the supply, often 20 volts or so, we have installed (*a*) a voltmeter to record the voltage applied to the projector by the 110-volt output transformer, (*b*) a mains rheostat for gradual changes, (*c*) a 4-way quick action rotary switch for rapid change from one transformer setting to another during a show.

Finally, dust has caused jamming of the metal safety shutter. This has, therefore, been removed. Stills can nevertheless be shown without burning the film by the use of the dimming resistance referred to previously.

A window fitted in the door enables the lower loop to be continually on view, and should this shorten, a little jerk with the finger downward restores it without stopping the machine.

To save life of the exciter lamp, an on-off switch has been fitted so that it need not burn while records are being played.

Improving the Sound Quality

Mechanical noise in the auditorium was minimized by building a projection booth about 7 feet wide by 8 feet deep by 7 feet high of sound absorbing "board". This necessitates a monitor speaker for the projectionist. An ordinary moving coil speaker works admirably, being connected through a condenser and transformer from the output of the last valve. The auditorium is unaffected.

Even with a speaker in the booth it is better to have sound controls operated by someone in the hall. The volume is therefore remotely controlled by a simple variable resistance of a few ohms, on stout 15 amp. leads. This is connected in series with the

S. R. P. Questionnaire Form for Individual Projectionists

The Film Committee of Local 150 is endeavoring to bring about important changes in the present film standards, which we hope, will bring benefit to our members. In order to do this, it is essential that you assist them by supplying the following information accurately.

Please designate which change-over system you use in your theater and return by mail to the Local Office as soon as possible.

☐ Do you use the change-over dots on the film?

☐ Do you use cue-meters?

☐ Do you use back-patches?

☐ Do you use a buzzer signal? (If a buzzer signal is used, check method employed to make signal.)

☐ Do you use tin foil to make your signal?

☐ Do you notch the edge of the film to make your signal?

☐ Do you make your own cue marks on the film? (Please describe the nature of the cue mark you make.)

....

....

☐ Do you use any other change-over system not listed above? (If so, please describe your system.)

....

....

The Committee would also like to have the membership's opinion regarding that portion of the run-down leader which informs them of the fader settings prescribed by the Studio.

Do you find the fader instructions, as given, of value?

....

Could the fader instructions be eliminated without seriously affecting your work?

....

Name of Theater..

Signature of Member..

If you have any other suggestions which you think would benefit the membership in our work, regarding the handling of films, please send them to the Local Office and address your communication to "Film Committee."

exciter lamp and so controls the volume. In case it should go wrong, the projectionist can short circuit it by an on-off switch.

Remote Mechanical Control

To control the tone from bass to treble was not possible electrically, but a simple mechanism of Mecano gear wheels and rods enables a remote mechanical control to be operated from the auditorium. Likewise there is a remote potentiometric control of volume on gramophone records.

Mechanical noise has also been minimized by mounting the projector case on sheets of sorbo rubber, and by insulating the whole of the moving parts on rubber at many points; also, by sealing up all apertures in the projector case, except, of course, the lens aperture. A felt-lined metal "funnel" between the lens aperture and the projection booth windows damps out mechanical noise proceeding from the former.

Mechanical vibration of both the exciter lamp and the photo-electric cell was found to give rise to background noise, and it was eliminated by further sorbo rubber padding.

Interference

Electrical interference producing hum was eliminated by using earth-shielded cables for all gramophone, microphone and photocell circuits, and putting all plugs—socket connections, switches, volume control, *etc.*, —in metal boxes which were earthed. All mains supply cables, *etc.*, were in lead sheaths which were earthed.

One defect in the sound was found only to occur after a film had already been shown once. This was a lack of clarity as though the sound were "out of focus". We attribute it to the heating of the film in the first passage through the projector causing it to warp and fail to fit snugly over the sound drum on its second passage through the projector. An effective cure was found by passing the film through a humidifier.

Novel Film Humidifier Used

This consisted of a metal box 4 inches long containing a synthetic sponge material soaked in water. The film passed over guide pulleys which keep it close to but out of contact with the moistened sponge. This seems effectively to restore the lost moisture to the film.

The house lights (six 200-watt bulbs) are dimmed very satisfactorily by a "water" resistance consisting of a 4-inch drain pipe full of sodium sulphate solution. The upper electrode is slowly raised in the solution thereby increasing the resistance in the circuit. The bottom of the drain pipe is sealed with a zinc plate electrode, a layer of pitch, and, finally, 1½ inches of cement.

A system of signals, consisting of four colored flashlamp bulbs enables the operator in the auditorium to signal to the projectionist such messages as "clean the top edge of the picture," "focus the picture," "give me more volume," *etc.*, and the projectionist has a reply signal also. In this manner we have had remarkable results over a considerable period of time.

AT YOUR SERVICE

A LARGE belt-drive wheel, such as from an old foot-pedaled sewing machine, used on an electric rewind will be found to be less injurious to film when rewinding. Although it takes more time, it cuts down the terrific noise generally caused by high-speed rewinds and gives the projectionists ample time to attend to other duties while the film is being rewound, and without the usual flapping and damage to reel ends at the end of the rewind.—H. E. Frisbie, *RCA, Pittsburgh.*

• • •

Instead of using sand or steel wool to catch the drippings in Suprex lamps, try using dish-washing wool such as "Chore Girl" or "Kurly Kate." These are plated or coated, and the drippings do not burn through as with steel wool, or splatter as with sand. In order to clean, just crumble the wool around and the catchings will all fall out.—P. C. McGaughey, *RCA, Boston.*

• • •

Small size food covers, those made of oiled silk with an elastic band in them, make excellent lens covers to be left on overnight. Several of my theatres have new f:2.0 coated lenses and the projectionists are anxious to take the best possible care of the lenses so these handy, inexpensive covers to the job okay.—B. A. Susan, *RCA, Dallas, Texas.*

Disney Magic Hailed by Lighting Engineers

The dewdrop fairies, one of Fantasia's high-spots have a constant aura of light produced through a combination of light thrown from behind the film in the camera, plus a skillful application of paint by airbrush technique. Photo copyright by Walt Disney Productions.

"YOU can't do it! Lights won't do things like that!" clamoured an illuminating engineer after seeing "Fantasia" at a meeting of members of the Illuminating Engineering Society held at the Walt Disney Studios in Burbank, Calif. Commenting on this demonstration of Disney cartoon wizardry, *Illuminating Engineering* observes:

He was right. We can't do things like that with lights . . . yet, but it's a goal to shoot at. Light is becoming a more and more important factor in decorative planning, and Disney is giving us, in pictures like "Fantasia," a beautiful and exciting target.

Interesting highlights of the technique followed by Disney in obtaining the beautiful effects with light and paint in his recent productions were described to the illuminating engineers by William A. Garrity, chief engineer of Walt Disney Productions.

Projection a Vital Edge

Of course, there's always going to be one effect which Mr. Disney can get which no one else can, Mr. Garrity said, and that is due to the fact that after he has arranged an effect with light and paint . . . he can then shoot more light *through* it! This of course occurs in the projection of the film.

And Mr. Disney has us in another respect, it was brought out, and that is because he can "cheat" a little bit, in a perfectly legitimate way, of course. That is, the definite patterns and results of lighting which illuminating engineers must consider in their plans simply don't exist for Disney and his crew of artists.

For instance, he can make a shadow any degree of intensity he wants, without taking into consideration anything relative in the lighting problem under discussion. Or he can back-light a moving object with a baby spot, moving the source of light one-hundredth of an inch at a time. And he can combine paint and light as no one else can.

One of the fundamental differences between the live action studios and Disney's is the use of props, Mr. Garrity said. Live action studios have large batteries of lights at their command for use in lighting their sets. The lights cast their normal shadows on characters and objects. When the actor walks through a lighted portion of a set, or into the shadows, maybe, the color of his face and costume is affected by the changing lights. But in the Disney productions, it is necessary to create that illusion of lights and lighting by an actual painted change in the colors of character and costume.

Shadows have to be animated too, naturally, and they are reproduced on the film by masking and underexposure. In every scene in "Fantasia," there is a definite light source. The shadows are cast according to this source and are kept consistent.

The layout department of the studio indicates on their rough layout sketch the source of light for a particular scene. It may be from a flickering candle or from a roaring fire on the hearth. It is then up to the artist to know how that particular source will throw light on the various characters, objects and props in the scene.

Special Animation Effects

Within the Disney studio there is a department called Special Animation Effects. The water scenes in several sequences of "Fantasia" were the result of this department's work. The same rosy glow you see around a sun-tipped cloud, the indistinct wisp of fog, the thin stream of smoke curling from a cigar—effects like these are done with the airbrush and Disney's specially-developed paints.

The charming Dewdrop Fairies which dart from blossom to blossom in the Nutcracker Suite, one of "Fantasia's" highspots, have a constant aura of light. This is produced through a combination of light thrown from behind the film in the camera and a skillful application of paint, through airbrush technique, on the front of the cell. The light "hit" the character squarely, while the paint "surrounded" the fairy. The curling ice-patterns in this sequence were produced by this same method.

The face of the gigantic Devil in Night on Bald Mountain, "Fantasia's" eeriest sequence, alternately lights and dims with the glow of the hellish fires over which he towers. This glow is painted on the Devil's face, but it is the continuity of exposures on one film which produces the realistic effect.

SLOT MOVIES IN ST. LOUIS

Slot-machine movies have extended their influence from their original starting mark in the Chicago territory. The Olive Novelty Co. announces that it has already sold 30 such machines, at $695 each, in St. Louis County alone.

PROJECTION CHIEFS HONOR F. H. RICHARDSON

IT'S a natural human tendency to forget those with whom we have been intimately associated in years gone by—which make the recent gathering of noted projection people at the home of F. H. Richardson all the more noteworthy. This get-together (arranged by P. A. McGuire, of the International Projector Corp.) was one of those gracious gestures designed to let the ailing "Rich" know that those for and with whom he worked for so many years in the cause of better projection have not forgotten and will not forget his many contributions to the advancement of the art and the craft.

"Rich," who will be 75 years of age next October, has not been in too good health of late and necessarily has had to curtail many of the activities which for years marked him as projection's most distinguished advocate. Veteran of the projection wars that he is, "Rich" has fought a thousand battles on practically every industry front. That he was not always successful in these efforts, and that he ever displayed a penchant for embracing lost causes, is but a footnote to his undoubted courage and sincerity.

Apparently the writer is going a long way off his course to lend force to these few words, yet there can be absolutely no question that "Rich" is the undisputed pioneer in and champion for years of the doctrine that better projection pays, that it must and will pay if only given the industry backing that so exacting an art and profession requires.

That's why these few lines of sincere appreciation appear on this page; and that's why some of the ranking projection men in the country got together and decided to honor "Rich" by descending *en masse* upon his home and carting him off to a gay dinner party. Present in the group, in addition the irrepressible P. A. McGuire, were Lester Isaac and M. D. O'Brien of the Loew's Theatres projection department; Harry Rubin of Paramount Pictures; Charles Horstman of RKO Theatres, and Will C. Smith of National Theatre Supply Co., one of the pioneer projection men in America. Frank Cahill, Warner projection chief, was prevented from attending the party only by a severe indisposition.

Standards Maintenance Pledged

The dinner party was held at Dick Hayes' place in Westchester County, N. Y., where the group was joined by both Dick himself and Arthur Martens, business agent and president, respectively, of Westchester projectionist Local 650.

Incidentally, the projection chiefs present assured "Rich" that they individually and collectively would spare no effort to maintain the present high standards of projection that have been built up through the years.

It seems fitting to suggest that the example of these ranking projection men be emulated by all projectionists who, in acknowledgment of "Rich's" long service in behalf of projection and in order to dispense a little cheer at a propitious moment, might want to drop at least a postcard to his home at 3 Tudor Lane, Scarsdale, N. Y.—J.J.F.

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An exceptionally handy article for projection room maintenance is a little hand blower, called an oil burner cleaner, which sells at the 10c store for about 25c. It is a rubber hand bulb with an 8-inch brass tube for a nozzle. When the tube is bent slightly it does a great job of blowing dirt from the aperture of a running projector. Mr. Tom Colwell, of the Bridgeport, Conn., I. A. Local 277, first brought this to my attention.—M. E. WHEATON, *RCA, New Haven, Conn.*

PALMER ADVANCED AT IPC

Arthur J. Palmer has been elected executive vice-president if International Projector Corp. For the past five years he has been assistant to President Earle G. Hines of General Theatres Equipment Corp. and, simultaneously, executive vice-president of Cine Simplex.

Academy Acoustic Recommendations

THE Research Council of the Academy of M. P. Arts & Sciences has issued a bulletin titled "Theatre Acoustic Recommendations" prepared by the Council's Theatre Sound Standardization Committee. These recommendations, prepared after conferences between the Committee, prominent architects, and acoustical and equipment engineers, embody general principles to guide the acoustical design and construction of sound picture theatres.

These principles, when applied, will improve sound reproduction and minimize or eliminate costly alterations in the completed auditorium. In designing a theatre auditorium, the architect is interested primarily in the usefulness and appearance of the finished structure. However, the auditorium shape, and the type, amount, and location of the necessary acoustic materials must guide in the construction and final appearance.

Proper Listening Conditions

The acoustical requirements for good listening conditions in an auditorium are that the sound loudness be adequate; that the components of the complex sound maintain their proper relations; and that the successive sounds in fast-moving speech or music be clear and distinct and that the auditorium be free from extraneous noises. These fundamental concepts are both necessary and sufficient for good listening conditions.

These proper listening conditions are affected by the following physical factors:

1. Size of the room.
2. Shape of the room.
3. Absorption characteristics of the acoustic materials and their placement in the room.
4. Extraneous noise level present in the room.

Two of the most common acoustical defects of a theatre, attributable to poor shape design, are echoes and sound concentrations. These as well as other defects can be avoided, and the optimum characteristics obtained by observing the following general rules.

1. The cubical contents should be kept to a minimum, consistent with the number of seats required.
2. The auditorium width should be from 50 to 70% of the length, and the ceiling height not more than 40% of the length.
3. Non-parallel surfaces should be used.
4. Convex rather than concave walls and ceiling sections should be provided. The wall and ceiling surfaces should also otherwise be broken up so as to thoroughly diffuse the sound.
5. The average absorption per square foot on the floor and ceiling should not be appreciably different from the average absorption per square foot on the side walls.
6. Well-upholstered seats and Ozite-lined carpet in the aisles should be provided.
7. The backstage should be so shaped and so acoustically treated that resonant reinforcements of sound will not be reflected into the auditorium to distort sound quality.

Stage Design Factors

In the design of the stage of the auditorium, two factors should be borne in mind. First, for proper viewing and listening conditions the first row of seats should be at least 20 feet from the screen, where the screen is not more than 16 feet in width.

For wider screens the first row of seats should be back an additional 15 inches for each foot of screen width over 16 feet. Second, the stage floor should be shaped to give an unobstructed view from the front seats, and the stage area should be covered with a rug or other sound absorption material to eliminate reflections directly from the loud speaker into the seating area.

Considering the type of backstage absorption treatment normally provided, it has been necessary for the theatre owners to completely cover the back of the screen with Ozite, with the exception of the space occupied by the loud speakers.

Suitably located drapes around and

above the speaker provide an efficient means of absorbing undesirable backstage sound reflections. However, this type of treatment is an added expense to the exhibitor and some form of speaker draping and screen masking should be combined in the initial design.

A large part of the noise transmitted to the auditorium often comes from the projection room. For this reason as much fireproof acoustic material as possible should be placed on the inside walls and ceiling of the room. As much of the projection room noise is radiated through open portholes or portholes with glass windows, these too should be treated.

Summary of Essentials

The essential design features as summarized in the Academy bulletin are:

1. A minimum volume consistent with the required seating capacity and proper auditorium proportions.
2. An auditorium width of from 50 to 70 per cent of the length and an auditorium ceiling height of not more than 40 per cent of the length.
3. The use of non-parallel surfaces; in particular, the floor should not be parallel to any ceiling section not opposite side wall sections parallel.
4. The use of convex rather than concave surfaces. In addition, the wall and ceiling surfaces should otherwise be broken up so as to thoroughly diffuse the sound.
5. Auditorium absorption characteristics to provide the same rate of sound decay in a vertical as in a horizontal direction from side to side or from back to front walls.
6. Heavily upholstered seats and Ozite-lined carpet in the aisles.
7. Backstage treatment giving a negligible amount of reflected or reradiated sound from the backstage into the auditorium.
8. A heavily carpeted proscenium designed for good viewing conditions from the front seating section.
9. Auditorium walls with sufficient sound insulation material to prevent extraneous noise entering the auditorium.
10. The projection booth acoustically treated with fire-proof material and projection ports equipped with acoustic baffles.
11. All equipment subject to vibration and hum such as arc generators, voltage regulators, lighting control equipment, etc., acoustically isolated from the auditorium.
12. Air-conditioning equipment of a high-volume, low air-velocity type with air ducts provided with acoustic baffles.

Long narrow auditoriums, high ceilings, excessively long and narrow balcony overhangs, concave focusing surfaces, and large unbroken reflecting areas should always be avoided, as acoustical faults will always result from their use.

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INTERNATIONAL PROJECTIONIST

JUNE 1941

VOLUME 16 • NUMBER 6

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With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

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Monthly Chat

FROM time to time we receive items from members of the projection craft who append thereto a postscript that runs like this: "Use this in any way you like, but don't put my name to it". We can't possibly understand the reason for such a request. Any item that is worthy of publication is worthy of having the author's name tagged to it. We won't refuse any such item in the future, of course, but we do wish that the craft were a little less bashful.

• • •

The first commercial theatre television apparatus in America (Rialto, N. Y. City) is strangely inactive, considering the ballyhoo that attended its installation. Report has it that should the Rialto management attempt to pick up and screen any of the regular television programs now on the air, the broadcasters will promptly institute legal action to bar the practice. On the theatre-television front all is quiet at the moment, but late Fall is expected to produce no little action in this direction—Uncle Sam's priorities list permitting.

• • •

Incidentally, every passing day brings new evidence of the ever-growing shortage of products that go to make up visual and sound projection units. If the many previous warnings anent the necessity for anticipating future equipment needs went unheeded, *now* is the time to swing into action on this score.

• • •

One of the most revolutionary inventions in the history of photography—the Increased Range system by means of which all objects in a given picture are in focus—is described herein. Our old friend and frequent contributor to these pages, Dr. A. N. Goldsmith, rates a bow for this development.

• • •

A Western supply dealer reports that an exhibitor customer declined to purchase sound equipment now because he feared that it would be rendered obsolete by the forthcoming control-track systems. However, the day was saved by the theatre projectionist, who, producing a copy of I. P., proved to Mr. Exhibitor that only minor changes would be required to adapt the equipment for the new recording. Result: a sale. Projectionists can use I. P. in this fashion for spurring the purchase of many needed items.

• • •

Not that we're giving the Government any hints, but did it ever occur to the craft that projectionists are admirably equipped for the job of manning the giant searchlights used in great numbers by the modern armed forces?

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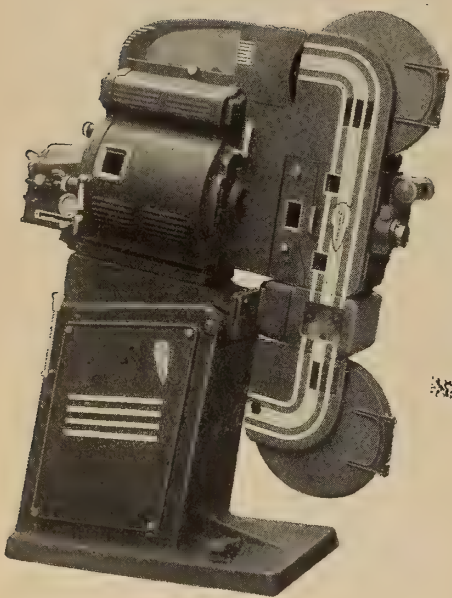

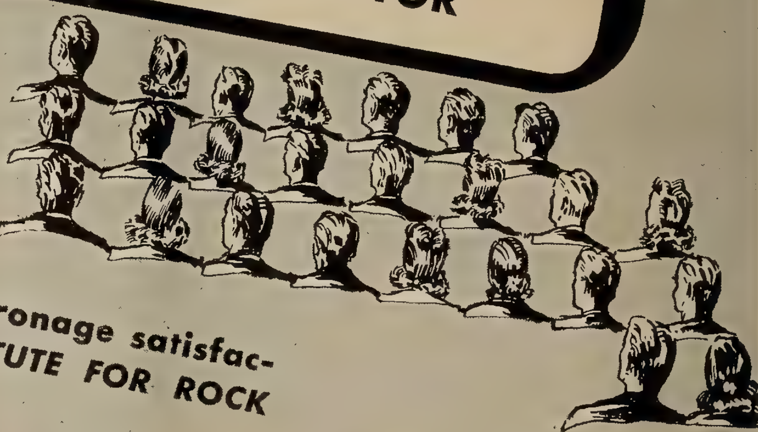

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INTERNATIONAL PROJECTIONIST

VOLUME XVI JUNE 1941 NUMBER 6

Lubricants and Their Applications

By LEROY CHADBOURNE

NO PART of the projectionist's daily routine is more important than lubrication; yet little attention has been accorded this subject. That the useful life of machinery is prolonged and multiplied by correct lubrication, and greatly shortened by lack of it, need not be stressed. But performance, too, depends extensively on lubrication.

One example among many, the writer recalls a pair of new standard lamphouses that delivered inferior light week after week. The carbon feed was hopelessly erratic, and so, of course, was the screen illumination. There was nothing wrong with the lamps. Through mistaken instructions, oil instead of grease had been used on a certain part of the feed mechanism. The same effect in lesser degree would have followed had grease of the wrong kind been used.

In addition to such special instances, every projectionist is familiar with the relationship existing between lubrication and performance in such matters as oil stains on picture or sound track, oil seepage in the soundhead, optical assembly, and so on.

The function of lubrication is to reduce friction and thereby to reduce: (*a*) the power needed for completely smooth operation; (*b*) abrasion, and (*c*) operating temperature. By reason of *a* lubrication results in better operation; points *b* and *c* refer to better maintenance and longer life.

Lubrication reduces friction by introducing a film or layer of lubricant between the moving parts, forcibly separating them and preventing them from rubbing on each other. However, lubrication which does no more than this, namely, substitute friction of metal-against-oil for friction of metal-against-metal, is only crude lubrication. Under ideal lubricating conditions the metal sustains *no* friction, and each metal surface attracts and holds to itself a skin or false surface of lubricant. This skin moves with the metal: ". . . the velocities of the fluids at the surfaces of the solids are those of the solid." It is this false skin of lubricant that undergoes friction against the body of the lubricant, while friction against the metal itself is zero.

Properties of Lubricants

To obtain and sustain this ideal condition calls for establishing and maintaining a very complex set of conditions. For one, there must be no eddies in the flow of the lubricant, since these would tear the false skin away from the metal. But to avoid eddies requires the choice of a lubricant in which density and viscosity bear a definite mathematical relationship to the clearances between the parts, and to their speed of motion.

In brief, *correct* lubrication is not a simple matter. That is why there are phases of the subject which are outside the scope of duties of one who is not a lubricating engineer. It is also a reason why the projectionist should avoid carelessness in those phases for which he is responsible.

A lubricant must have properties enabling it to, among other things:

(1). Force or insinuate itself between the parts to be lubricated, separating them physically.

(2). Maintain a continuous, unbroken film or layer between those parts.

(3). Flow smoothly and evenly under the motion of the parts, setting up no eddies.

Note particularly that the lubricant which performs these functions perfectly under one set of mechanical conditions may be useless under a different set of conditions.

The mechanical conditions to be considered include, among others:

(1). The clearance between the parts.
(2). The speed of motion.
(3). The pressure between the parts.
(4). The shape of the clearance. In some modern designs parts are arranged to face each other at a slight angle, producing a wedge-shaped clearance into which oil is forced, much as air is forced and compressed under the wing of a moving airplane. This arrangement calls for oil of lower viscosity.

The properties of a lubricant which indicate its suitability for a given set of mechanical conditions include viscosity, density, oiliness, and wetting power.

To explain viscosity is to explain how it can be measured. A standard quantity

of liquid is allowed to run off through an opening at the bottom of a standard container. Water or, say alcohol, will drain out quickly. A thicker liquid will take longer to ooze through. The process is timed: the number of seconds the liquid takes to run out is called its "viscosity number."

Density is the same thing as specific gravity, the measurement of which is familiar to projectionists.

Oiliness is a term sometimes used to describe the ability of a liquid to maintain an continuous, unbroken film or layer. In this respect vegetable and animal oils are sometimes superior to mineral oils, and may be added to lubricants despite the fact that they are less stable chemically.

Wetting power is easily understood by remembering how water on glass tends to bunch up into separate drops, leaving some of the surface quite dry, instead of spreading out evenly over the entire surface. A good lubricant must wet the entire surface it is intended to lubricate, and not act as does water on glass. Wetting agents — soaps of various kinds are wetting agents—may be added to lubricants. They also are chemically less stable than mineral oils.

The chemical instability of some ingredients in lubricants emphasizes another requisite property of a good lubricant. It should exhibit only a minimum of deterioration even under the highest local or interior temperature to which it may be exposed at the point of maximum pressure.

Vegetable oils take up oxygen from the air and thicken—as exemplified to an extreme degree by the kind of vegetable oils used in paints, which go far beyond the point of thickening and become hard and brittle. The kind of vegetable oils used in lubricants may show a tendency in the same direction but to a vastly lesser extent. This fault, like the tendency to break down chemically under heat and pressure, must be held to a minimum in any lubricant worth using in the projection room.

Selection of Lubricants

Scientific selection of a lubricant for a given job involves very careful matching of its properties with the physical conditions of operation. Superficially, this is obvious enough. Viscosity, for instance, has an important bearing on function (1) referred to previously—the ability of the oil to force itself between the moving surfaces and sustain itself there. Thin projector oil obviously will not lubricate the shaft of a large generator: it does not have enough viscosity to force the heavy shaft up off the bearing and sustain itself as a layer between the two. Thick generator grease plainly is too viscous for the intermittent movement: it cannot form a thin enough film and its friction with itself is too great.

Other considerations, leading to scientific choice of the best possible lubricant, involve detailed consideration of clearances, including their shape; speed of motion; pressures in the bearing or other part to be lubricated; temperature of operation; velocity/density ratio of the lubricant; wetting power with respect not to any surface but to the exact materials of alloys in question; oiliness; ability to resist chemical deterioration under the given temperature and in contact with the given materials —and other factors.

'Getting by' Not Enough

Obviously, the projectionist can not make a scientific selection of lubricants. If he were a lubricating engineer he still couldn't do it, unless he also had a great deal of factory information about the equipment to be lubricated. It is plainly not the responsibility of the projectionist to select lubricants, nor should he be asked to do it. If he is made to do it, and the life and performance of equipment suffer, that is not his fault.

The projectionist cannot even select a lubricant on the basis of experience. Experience may tell him that a given oil "got by" on a given job. "Getting by" and giving the best possible results are two very different things.

There are a great many things the projectionist can and should do. To begin with, he can take the trouble to find out — and then follow faithfully — the lubricating recommendations of the manufacturer on each item of his equipment. Presumably these recommendations are sound since the manufacturer naturally is concerned about the reputation of his equipment.

He can avoid the easy-going temptation to substitute sewing machine oil for projector oil, and vaseline for real bearing grease. Remembering the great variety of factors bearing on the choice of a lubricant, he can convince himself and anyone else that such careless substitutions haven't a chance in ten thousand of working out correctly.

Projection Room Tests

Where substitution becomes inevitable —if the original supply be cut off, for example, or if the management insists on false economies — there are some rough tests the projectionist can easily make. *These tests can not show that a suggested substitution is satisfactory, but that it is unsatisfactory.* They consist of roughly accurate comparisons between some properties of the suggested substitute and the same properties in the recommended lubricant.

Viscosity: To compare viscosities, get a piece of glass tubing with as fine a bore as possible: an extra-long medicine dropper will do in a pinch. Mark it top and bottom. Suck up oil to the level of the top mark; let it run out under gravity to the level of the lower mark. Time this last process with a second hand of a watch or with a stop-watch. Clean the tube thoroughly with carbon tetrachloride and let it dry completely before sucking up the next oil to be tested. Oils of the same viscosity will take the same number of seconds to run out of the tube.

Density can sometimes be measured with the battery hydrometer, noting, however, that specific gravities of battery fluids run from 1.05 up to about 1.30, whereas those of lubricants run downward from 1.00 to 0.9 or perhaps even 0.8. The hydrometer float used must have an extra long stem above the 1.05 mark on which additional markings can be added. These need not be placed accurately, for the projectionist will not want to measure the density of the oil but only to compare it with the density of another oil. All battery hydrometer floats cannot be used; some will sink to the bottom. The reading takes longer than reading a battery, since more time must be allowed the float to come to rest in the more viscid medium.

Wetting power can be checked roughly by cleaning and polishing a surface of the same material as that to be lubricated, and sprinkling a little lubricant on it. It should flow out evenly and wet all the surface, not bunch into droplets.

These rough comparisons ignore completely the "oiliness" of a lubricant, its chemical stability in use, its tendency to promote or retard corrosion of the parts in contact with it, and other factors. Therefore they can not evaluate definitely a given lubricant; but they will

Why Not Use This?

I have found that use of the theatre's vacuum cleaner as a means of cleaning dust out of amplifier bays and drive motors greatly facilitates this important operation. I have also found that frequent use of this method has resulted in a considerable reduction in operating temperature of drive motors, especially on the universal base equipments where dust and fluff lodges between slots on the generator end of the motor and around brush holders. This accretion, of course, prevents circulation of air through the motor.

In one case where it was impossible to hold one's hand on the motor, I found by blowing the dirt out of the motor that normal operating condition resulted, doing in five minutes a job that would take half an hour or more if the motor were to be dismantled. By using this method on amplifier bays no fear need be had that wires will be broken, and ready access is had to the hard-to-get-at spots. — V. SHARP, *D.S.E.L., Montreal, Canada, via ALTEC.*

indicate the suitability of a lubricant as a substitute.

The projectionist can never correctly determine the amount and frequency of lubrication needed for best results. Under-lubrication is an obvious fault with obvious consequences. But over-lubrication can also cause serious trouble. The effects of over-lubricating the projector have already been cited. Picture and sound track may be soiled, the sound optical system soak up oil and give a yellow light, the soundhead insulation deteriorate and the sound become noisy.

Equally undesirable results may follow if a motor is over-lubricated. Excess oil is spattered by the centrifugal force of the rotating elements, and gets into insulation and on the commutator. Sometimes, particularly in carbon-feed control and projector drive motors, deterioration of insulation results in leakage currents and unstable performance. In these motors, no less than in motor generators, the voltages and currents encountered are such that oil-damage to insulation not infrequently results in a burn-out. Oil on the commutator can produce sparking and pitting.

Lubrication Routines

To strike the proper balance between under- and over-lubrication, follow instructions. Don't try to invent them. Consult sight-gauges wherever they are provided.

A very good trick is to write or type lubricating instructions on a small slip of paper and fasten them permanently near each oil cup with cellophane adhesive tape, the tape completely covering and protecting the paper slip. Instructions thus placed can never be lost, or soiled beyond simple cleaning with a damp cloth. Relating to the quantity and type of lubricant, they are thus visible to all members of the crew, including relief men.

As to frequency of attention, make a simple chart listing daily, weekly, monthly and semi-annual lubricating requirements. Establish definite hours of each day, a day of each week, month and half-year, for consulting the chart. This simple system not only prevents neglect but avoids over-lubrication. Without something of the sort, anxiety to avoid under-lubrication may result in multiple oil-baths, either by the one man or by other members of the crew.

Contamination of Lubricants

Another thing the projectionist definitely can and must do is protect lubricants from contamination. Sources of such contamination are many. Contamination takes place during and before use.

Contamination during use results from picking up dirt and dust present at the point undergoing lubrication; also from chemical deterioration under heat and pressure whereby the lubricant becomes contaminated with by-products of the decomposition; also (when lubrication is imperfect) there are particles resulting from abrasion.

All of which means that the lubricant must be changed periodically, unless the mechanical arrangements are such that it changes itself automatically, washing away as fresh lubricant is applied. Under all other conditions cups and wells must be drained, wicks changed, *etc.*, at regular intervals, depending on circumstances.

When decomposition results in the deposit of a thick, gummy residue which won't drain out, such residue must be washed out. There are two general ways to do this. One is to use a solvent, benzine or preferably carbon tetrachloride (which is more volatile) or a mixture of both. It is important that such solvent evaporate completely before new lubricant is added and used, otherwise the fresh lubricant will be thinned by it.

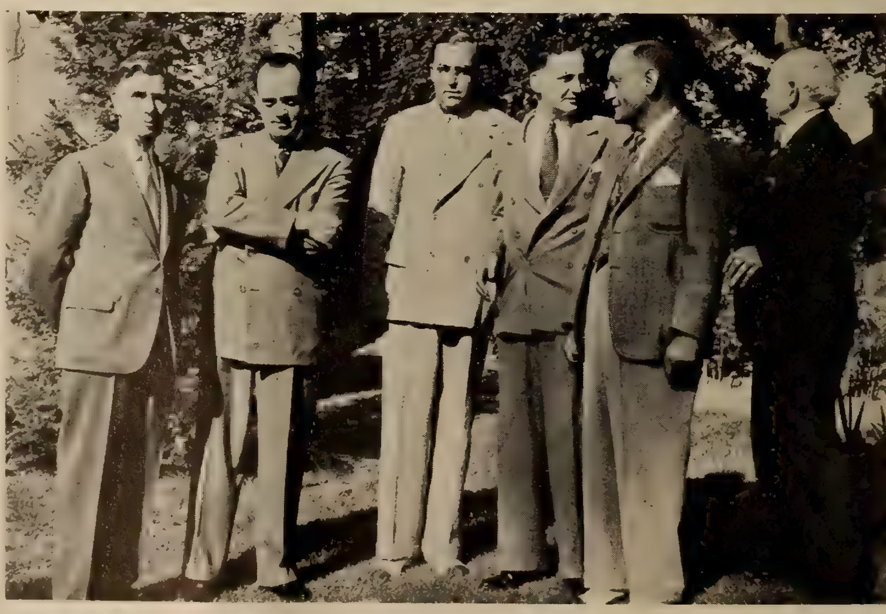
A second and common procedure is to use the lubricant itself as a solvent for the deposit, which can usually be done by heating it. Pour it in hot. It will flush the gum away. Sometimes a small amount of heated lubricant applied to generator bearings will not stay hot. The great masses of metal will chill it; and gum clinging to a shaft, let us say, may never be warmed to the point of flushing off. Consequently the use of a cold solvent, such as carbon tetrachloride, may give better results. Or both methods may be used in succession, depending on circumstances. When oil-change day comes around, the parts undergoing lubrication should be examined, and cleaning continued until all gum is eradicated.

Frequently lubricants are contaminated before use. A prime contaminator is water condensed from the air. In winter, for example, when the projection room cools overnight, atmospheric moisture will condense in an open oil can. Since oil floats on water, any condensed moisture will sink to the bottom of the can, where it will not be seen and cannot re-evaporate. It will be shaken into the oil later, and so reach and rust some bearing. In summer, the same thing happens when the air conditioning system is operating.

Keep oil containers closed.

Another way water gets into oil is when a pressure can is used. Water is pumped in with the air and condenses. Never pump more air into such a can than is absolutely necessary. Other corrosive additions are plain dirt, wax (from the interior of some containers) rust and acid. All must be guarded against.

Scraps of wax from the lining of a container, loosening and floating in the oil, have been known to tie up an intermittent movement. Inspect oil for traces of wax. Rust comes from steel cans when water gets into oil in one of the aforementioned ways. Particles of rust damage intermittents or scratch close-fitting bearings. Acid traces are sometimes present in new oil cans which have been copper-plated, or otherwise plated, by processes involving use of an acid bath. A new oil can should be thoroughly washed and dried before it is used, particularly for projector oil.



Leading projection men on surprise visit to the ailing F. H. Richardson at his Scarsdale, N. Y., home. Left to right: Will C. Smith, National Theatre Supply Co.; Lester Isaac, projection chief of Loew's Theatres; M. D. O'Brien, asst. Loew's projection chief; Charley Horstman, head of RKO Theatres projection department; Harry Rubin, who supervises projection for Paramount, and P. A. McGuire, of International Projector Corp., who, as usual, seems to be directing operations.

'Increased Range' System Promises to Revolutionize Photography

The solution of a problem that is as old as photography—the fixed focus and limited depth of field of a camera lens—is at hand as a result of the brilliant work of a group of scientists who have made available the new "Increased Range" system of photography. One of the most extraordinary aspects of this new system is the fact that its use does not require the replacement of any existing standard lighting or photographic equipment, the vast improvement being gained merely by the addition thereto of a few units.

***The accompanying article, written for the* New York Times *by its noted technical editor, Waldemar Kaempffert, details the what, why and how of the system which represents such a gigantic stride forward in the progress of photography and which bids fair to revolutionize all previous and existing notions of what constitutes excellence of pictorial composition.—*Editor.**

TWO patents for revolutionary inventions in motion pictures have been granted to Dr. Alfred N. Goldsmith, Harry R. Menefee, William Mayer and Fritz Kastilan—revolutionary because they solve a problem which has hitherto baffled optical experts, motion picture engineers, cameramen and producers and which has long been a stumbling block in the artistic development of the film play.

The purpose of the inventions is to produce motion pictures in which all objects are always in focus. "Increased Range (I.R.) system" is the name given to this new method of solving a problem which is as old as photography.

Problem of Fixed Focus

To explain what the I.R. system accomplishes compare the human eye with the camera. The normal eye can accommodate itself to any distance. But a camera lens? It has a fixed focus. A vase of flowers on a table may be sharp in every detail, but books on shelves in a background twenty feet away are mere blurs. The camera lens has what is technically known as a limited "depth of field."

It is true that "depth of field" can be somewhat increased by inserting small stops within the lens, these being little diaphragms with holes in them. The size of the diaphragm is usually indicated by a number: thus a lens working at $f/2.8$ has an aperture of 1/2.8th of its focal length. The smaller the aperture the greater the depth of field.

Though it is possible thus to bring near-by and some distant objects into focus, even though they may be separated, for example, by a distance of twenty or thirty feet, the time of exposure must be greatly increased because much light is cut off.

The image of a point of light formed by a lens is theoretically a mere point; practically it is a small circular image known as the "circle of confusion." For motion picture work the maximum tolerable diameter of the "circle of confusion" in a "point image" must be no greater than 0.002 of an inch. When this condition is met the image is said to be in focus.

But an image of a point larger than this initial diameter is blurred. Accordingly, there is only a limited range of distances or regions within which objects can be sharply focused for a given position of the lens.

Translate this into actual practice and see what happens. An actor is seated at a table 10 feet from the camera. The depth of field at that distance with a lens of 50 mm. (2 inches) focal length and $f/2.8$ aperture is only 3 feet 6 inches. Anything between 8 feet 6 inches and 12 feet will be in focus, but everything closer than 8 feet 6 inches or farther away than 12 feet will be out of focus.

The actor may move less than 4 feet while keeping in focus. Hence the lines chalked on the floor of the studio and hence the rigid instructions not to overstep them.

Spectator at a Disadvantage

Suppose a deeper set is divided by four vertical planes into four regions. If all four regions are to be in focus at any one time a $f/2.8$ lens must be stopped down to $f/11.3$. But the light-gathering power of the lens is then reduced to one-sixteenth of what it was at $f/2.8$. Hence sixteen times as much light must flood the scene if the illumination is to be satisfactory.

Since this means sixteen times as much electric power in a studio that is already as brilliant and as hot as it can be, stopping a lens down is no solution of the problem presented.

In order to overcome the difficulties imposed by such a situation it becomes necessary to make a succession of "shots" —long, medium and close. Often enough the camera must be directed first at the hero and then at the villain, leaving the spectator in the theatre to infer what the action between the two really is.

There is no optical way of overcoming this difficulty. Lenses are made of glass. Their focal length at any instant is definite, and their depth of field limited. Hamlet may move on the legitimate stage backward and forward from the footlights to the remotest backdrop, but his audience has no difficulty in keeping him in focus. As a result the theatre is able to present life as it is—a flow of movement and not a succession of glimpses.

The problem thus presented has been solved with extraordinary ingenuity and effectiveness by Dr. Alfred Goldsmith and his co-inventors by a revolutionary method of lighting the set and by a new method of making exposures.

Suppose that the actor to be photographed is ten feet distant. When the Increased Range system is used the camera is focused accordingly and the exposure made under the proper illumination.

Suppose that the actors move either ten feet forward or twenty backward or any other distance within the confines of the set. The lights for the "first shot" are quickly turned off, another set for the new "shot" is quickly switched on, the camera is focused at the new region and another exposure made on the same frame of film.

Imagine this flashing of lights on and off and this simultaneous refocusing occurring incessantly and with such rapidity that the entire depth of the set is covered in focus in each complete film picture. Then, no matter where an actor may be, he is necessarily in focus.

There may be ten, fifteen, or any number of lights in banks to illuminate each of the regions and planes in the set. The banks or groups are switched on and off 48 times a second in sequence, which means that, so far as the eye can tell, the studio is highly and steadily illuminated. There is no

EVIDENCE OF THE VAST SUPERIORITY OF THE 'INCREASED RANGE' SYSTEM OVER STANDARD PHOTOGRAPHY

At the left a picture made by conventional photographic methods. At the right the same scene made in accordance with 'Increased Range' principles. Note particularly the striking contrast in background detail disclosed by these shots shooting conditions the same for both scenes, i. e., a 50 mm. lens operated at f/1.4 with the foreground distance being 8 feet, the background 18 feet. In motion picture work under the I. R. system actors could move about freely and still be in focus.

flicker, and no limitations are placed on lighting.

What we have here is a new application of the phenomenon called "retinal persistence." When we see a motion picture, we actually see 24 pictures a second, but before the eye has grasped one the next is presented, with the result that we see a leg or an arm moving not step by step but in a continuous natural sweep. So with these lights. Before the eye is aware that those in one region or plane have been turned off they are on again.

'Diffo' Subs for the Shutter

But how is the camera focused synchronously with lights as they flash from region to region? The answer is found in a "diffo" which takes the place of the ordinary shutter and which consists of a number of glass plates of different thicknesses.

As the lights are switched on and off the diffo is automatically turned synchronously to bring new plates successively between the lens and the film. Each glass plate changes the focal plane of the lens. Plate 1 of the diffo will insure correct focusing for a region between ten and fourteen feet, for exampe.

All this takes place continuously and automatically. The lights flash on and off 48 times a second to illuminate successive regions and the diffo keeps pace to interpose between the lamp and the film the glass plate needed to focus sharply on anything in the region illuminated at the moment.

We must imagine the diffo rotating rapidly and incessantly while the camera is directed on the set and actors moving freely just as they would on an ordinary stage. Every object on the finished picture is sharp, whether it is a sign fifty feet away or a face three feet away.

Motion-picture producers are excited by the photographic as well as the dramatic success of "Citizen Kane." The two successes are intertwined for the simple reason that in "Citizen Kane" the interiors have "depth of field," meaning that, on the whole, near and far objects are more or less in focus.

It is reported that Orson Welles insisted on pictures free from blur. His camera man, Gregg Toland, knew full well that the impossible was demanded. He obliged by doing the possible. In other words, he selected a short-focus lens and stopped it down to gain the desired depth of field—but at the price of exaggerated and distorted perspective and also of illumination. No doubt gloom does help some of the scenes of "Citizen Kane," but the plain truth is that gloom was unavoidable in order to gain depth of focus.

Effect on Acting Technic

The Increased Range system means not only a revolution in motion-picture photography but in acting for the screen. Gone are the old warning, cramping chalk lines; gone the careful measuring of distances and worrying about feet and inches; gone the necessity of making long, medium shots and close-ups where they are required only to obtain a semblance of continuity.

Time of actors, director and technicians is conserved. Worthless "shots" are reduced in number. Pictures gain in dramatic action and appeal. Sets may be designed with far more freedom. Actors lose their feeling of restraint and therefore perform more naturally, with a larger sweep. And for motion picture spectators there is an immense gain in dramatic quality and continuity.

The problem of focusing is exactly the same in television, for the video camera of television is much the same as any ordinary camera. Hence the increased range system applies to television as well as to motion picture photography. Moreover, in television, retakes are impossible. There is but one performance, and if that is unsatisfactory for a dozen reasons, of which bad focusing may be one, there is no remedy.

Parallel in Television

What Dr. Goldsmith and his associates have developed is a system of three-dimensional scanning. In television a little spot of light scans a face or scene line by line, just as we read a book. The scanning takes place so rapidly that we are not aware of it when we see an image on a television screen. Now we have a system of scanning in planes—something which marks a revolution both in motion picture photography and in motion picture art.

W. A. WOLFF, OF W.E., DEAD

W. A. Wolff, information manager of both Western Electric Co. and Electrical Research Products, Inc., and long active in advertising and public relations, died recently while on a vacation trip to Maine. He had been ill for several months at his home in Woodmere, L. I., N. Y. Surviving are his wife, Dr. Harriette Hart Wolff, and three children, John Carl, Catherine and Dorothy.

Mr. Wolff was advertising manager of both W. E. and ERPI from 1929 until he became information manager in 1940. Advertising and publicity for W. E. sound motion picture equipment were under his supervision from the time "talking pictures" were first introduced. In this capacity, Mr. Wolff was a firm believer in and lent powerful support to the theory that the projectionist was no less an important factor in the selection and subsequent successful operation of visual and sound projection equipment.

The Intermittent Carbon Arc†

By *F. T. BOWDITCH, R. B. DULL* and *H. G. MACPHERSON*
RESEARCH LABORATORIES OF THE NATIONAL CARBON COMPANY, INC.

Although the carbon arc is usually considered as a continuous source of light, the experiments reported in this paper show that it may be used for the generation of light surges as well. If these surges are made to occur at a rate so fast that the arc stream does not have time to deionize between them, then the electrical circuit may be completely broken at the conclusion of each surge and closed again to initiate the next one. For longer periods between surges, a very low maintaining current is employed. The timing and duration of the light pulses are controlled by electronic switching of half-cycle current surges from an alternating-current supply.

For a given size of carbon, much higher brilliancy and candle-power can be obtained in intermittent than in continuous operation; a brilliancy of 1600 candles per sq-mm is reported for a 7-mm carbon of the "Suprex" type. The efficiency of the intermittent carbon arc is limited by the thermal lag in the electrodes, in that they continue to radiate energy for a considerable period after the current is reduced to zero at the end of each surge.

THE carbon arc is usually considered as a continuous source of light, although it is used only intermittently in motion picture photography and projection, the particular intervals of light usage being determined by the camera or projector shutter. Since as much as one-half of the light generated is wasted in this way, worth-while economies would appear to be possible by the elimination of this waste through the intermittent generation of light as needed.

Interest in such an intermittent light-source was further stimulated by the theoretical demands of a radically new system of motion picture photography, known as the "I-R," or "Increased Range System," sponsored by Dr. Alfred N. Goldsmith and others. In a typical application of this system, very short light-pulses of only one-eighth the duration of a single frame are required, separated by dark periods three times as long. Such a light-cycle, supplied by a continuous source and shutter, would necessitate the waste of 75 per cent of the generated light.

† J. Soc. Mot. Pict. Eng., July, 1941.

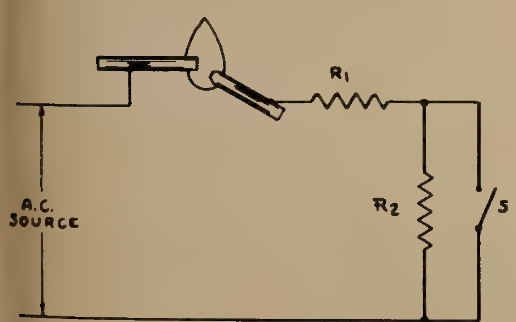


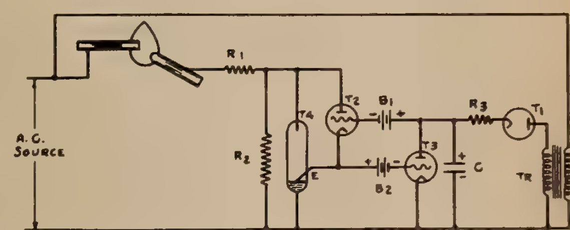
FIGURE 1

Simplified circuit diagram of the intermittent carbon arc.

In attacking the general problem of an intermittent carbon arc, the idea was first conceived of employing an A.C. source of suitable frequency with switching circuits permitting the delivery of heavy current surges to the arc during selected positive half-cycle intervals. Thus, while the arc would be maintained between surges at a low value of alternating current, it would operate as a D.C., high-intensity arc during the half-cycles when a heavy surge current was permitted to flow.

FIGURE 2

Circuit diagram of the intermittent carbon arc with surge timing control at the beginning of any chosen half-cycle.



A simplified diagram of the electrical circuit employed for this purpose is shown by Fig. 1.

In this figure, the carbon arc is shown in series with two ballast resistors, R_1 and R_2, across an A.C. source. One of these resistors, R_2, may be intermittently short-circuited as desired through the switch S shown at the right. The combined resistors limit the current to a minimum value necessary to maintain the arc between surges; the single resistor R_1 determines the magnitude of the surge current which will flow while the switch S is closed.

If rapid flashing of only one-half cycle duration is desired, then a simple knife-switch of the type indicated can not, of course, be used. A mercury-vapor switch of the ignitron type, however, completely satisfies all requirements as to capacity and speed and has been successfully employed in a number of circuits.

Details of Timing Circuit

The complexity of the timing circuit which tells the ignitron when to short-circuit the ballast resistance is determined by the nature of the light-pulses required. For instance, if a surge is to be delivered every positive half-cycle, the ignitron and timing circuit can be dispensed with entirely and a simple half-wave rectifier used. However, if succeeding surges are to be separated by one or more idle cycles, then a more complex arrangement is required. A circuit found suited to this type of service is illustrated by Fig. 2.

In this circuit alternating voltage from the same source that supplies the arc is used to charge a condenser C through the transformer TR, the half-wave rectifier T_1, and the resistance R_3. This condenser is connected in the grid circuit of a mercury-vapor thyratron T_2 with polarity such that the condenser voltage opposes that of the negative bias battery B_1, reducing the negative grid potential of T_2 as the condenser charge increases until this thyratron is tripped.

In tripping, current is permitted to flow into the ignitron firing electrode E, vaporizing the mercury and causing the ignitron T_4 to conduct, which short-circuits the ballast R_2. As the ignitron fires, the voltage across it drops to a value below the extinction point of thyratron T_2, so that this tube is extinguished.

In the meantime, the voltage developed between the electrode E and the mercury pool during firing overcomes the bias voltage B_2, tripping the small argon-filled thyratron T_3 so that it may discharge the condenser C. Finally, at the

end of one half-cycle, when the voltage across the ignitron falls to zero, it, too, is extinguished, so that all elements are returned to their initial condition ready to set off the next surge.

The timing of this circuit may be adjusted in a number of different ways, since firing can not occur until the grid voltage of the thyratron T_2 reaches a specific minimum value. For instance, the secondary voltage of the transformer *TR*, the magnitude of the resistor R_3, and the magnitude of the condenser *C* may be independently adjusted to determine the number of half-cycle charging pulses needed to raise the condenser voltage to the critical tripping value. Also, this critical voltage value may be adjusted by changing the voltage of the battery B_1 which must be overcome. By phase reversal through the transformer *TR*, the condenser is charged during half-cycles when the voltage is negative, so far as the main arc circuit is concerned; thus the condenser voltage remains steady during the positive half-cycles when firing might occur.

In practice, circuit values are so adjusted that the voltage across condenser *C* is a little too low during the positive half-cycle just prior to the one when firing is desired, so that it will be appreciably above the required minimum when wanted.

The circuit just described insures that firing will occur very early in a predetermined half-cycle as desired. It will not, however, permit adjustment of the firing time throughout the duration of a half-cycle, and thus does not provide for a current surge lasting for only a predetermined fraction of a half-cycle. A circuit permitting such adjustment is shown by Fig. 3.

Firing Time Adjustment

The left portion of this figure up to and including the thyratron T_2 is identical with that of the previous figure. Also, that portion of the circuit including the transformer TR_1, the single-wave rectifier T_1, condenser *C*, and resistor R_3 constitute the essential timing circuit as before, but now operating to raise the plate voltage of thyratron T_3 to its tripping point, so that the resulting discharge through the resistor R_4 may trip T_2.

The tripping of thyratron T_3, however, is also dependent upon the grid voltage pulse received each positive half-cycle through the transformer TR_2. This transformer has a constricted iron magnetic path giving a very peaked waveform conducive to accurate timing of the voltage pulse, and the primary is supplied through the phase-shifting network composed of the four elements in Wheatstone bridge arrangement at the right.

As with the previous circuit, the condenser *C* receives its charging pulses during negative half-cycles when the grid pulse applied to thyratron T_3 is of opposite polarity to that required for firing. On positive half-cycles, therefore, when firing might occur, the voltage across the condenser remains fixed, so that timing is solely controlled by the grid pulse.

In operation, then, the thyratron T_3 receives a firing pulse once each positive half-cycle, in a phase relationship with respect to the source as determined by the setting of the phase-shifter circuit. If, during the preceding half-cycle, the voltage of the condenser *C* has risen to a sufficiently high value, the tube fires, tripping thyratron T_2 and ignitron T_4 along with it. The act of firing discharges the condenser, so that the circuit automatically clears itself, ready for the next sequence.

The time required for all these things to happen is, fortunately, only a matter of microseconds, from the firing of the first element in the chain of either one of the circuits described until the light-surge is emitted by the arc.

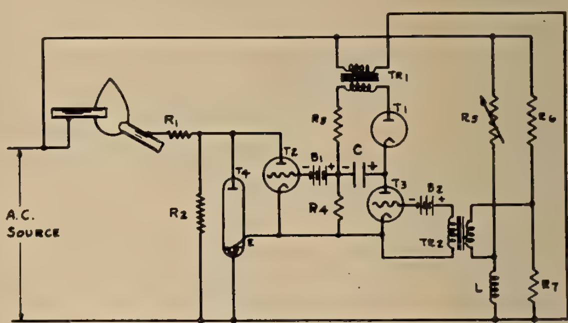
which the discharge through the arc starts. As previously mentioned, however, once the discharge has started it will continue until the end of the half-cycle, since there is no way of extinguishing the ignitron until the voltage across it falls to zero.

Using the circuit of Fig. 3 and a 96-cycle source firing on alternate positive half-cycles, a series of measurements was made using the same ballast resistors in series with the arc, but starting the surge-current at different points after the start of the half-cycle. It was found that the peak candle-power during a surge is highest when the firing is started as soon as possible in the cycle, because of the greater crater area obtained. The peak intrinsic brilliancy, however, remains constant throughout a wide variation of starting phase-angle, from 30 to 75 degrees.

When the arc is started at a large phase-angle, that is in the middle or toward the end of the half-cycle, it emits an intense throbbing noise at the flashing frequency, which gradually decreases to a minimum as the phase of starting is shifted toward the beginning of the cycle.

FIGURE 3

Circuit diagram of the intermittent carbon arc with surge timing control at any time during any chosen half-cycle.



The choice of frequency of the A.C. source is governed by the light-pulse timing required for a particular service. For instance, in motion picture projection at 24 frames per second, a 48-cycle source might be used, with current surges every positive half-cycle, giving a light-pulse of $^1/_{96}$-second duration as with the present 90-degree shutter. In the "I-R" system of motion picture photography previously described, a 96-cycle source with a half-cycle duration of $^1/_{192}$ second could be employed, with the timing circuit set to give surges during alternate positive half-cycles.

Signalling applications might also be conceived in which any commercial frequency could be used, and the tripping of the ignitron controlled through the tapping of a telegraph key or other contacting device to give successive bursts of light, each consisting of a series of half-cycle surges.

The firing circuit shown in Fig. 3 is best adapted for experimental work, since it will do everything the simpler circuit can accomplish and, in addition, permits variation of the phase-angle at

The circuits for the intermittent arc so far described call for the use of sustaining current between flashes, conducted through the ballast resistor R_2 of Figs. 1, 2 and 3. It was soon found, however, that when the flashes occur as often as every other cycle at 96 cycles per second, this sustaining current could be reduced to zero. That is, the resistor R_2 could be omitted entirely from the circuit, and flashes initiated from a complete open-circuit condition.

The time between flashes is so short under these conditions that the arc does not have time to deionize completely, so that a conducting path remains for enenergy to fire the ignitron and then reestablish the arc. It was also found possible to operate the arc with a small sustaining direct current, provided, of course, that the D.C. sustaining source and the A.C. surge source were otherwise electrically independent.

Two considerations proved to be important in determining which of these three arrangements was the best, *i.e.*, an alternating or a direct sustaining current,

or none at all. In the first place, if it is desirable that the light between flashes should be kept as low as possible, then the arc should be operated without any sustaining current, since a minimum light between flashes is obtained in this way. However, this is possible only when the time between flashes is very short.

Another consideration of importance in this connection is that of the steadiness of the arc. One of the principal difficulties originally encountered was an unsteadiness in the light output associated with a wandering of the negative flame to various positions in front of and around the positive carbon, due to wandering of the cathode spot around the tip of the negative carbon. Apparently this spot did not remain anchored in one place when the current was reduced between flashes, since the current-density was then too low to load the negative carbon adequately.

Using regular negatives, it was impossible to eliminate this unsteadiness so long as an alternating sustaining current or a zero sustaining current was used. The use of a direct sustaining current, however, held the cathode spot in one place, and eliminated this type of unsteadiness. It was found also that the use of a small-diameter, copper-coated graphite negative was helpful in this respect, so that a reasonably steady arc could be achieved when no sustaining current was used. No means were found, however, for completely steadying the cathode spot when an alternating sustaining current was used.

Both positive and negative carbons for use with the intermittent arc must have sufficient current capacity to carry the rms or effective current without overheating. In cases where the surge current is passed through the arc at frequent intervals, as in the "I-R System" application, it is desirable to use carbons of greater electrical conductivity than those of the same diameter conventionally used in D.C. arcs.

One of the best positive carbons for this purpose was a 7-mm "Suprex" with a copper coat of twice the usual thickness. When operated with no sustaining current, this carbon gave the steadiest performance without rotation, and in combination with a 5.5-mm copper-coated graphite negative at an angle of 20 to 30 degrees with the positive. At greater angles, a lip forms on the upper edge of the positive carbon, causing unsteadiness and a decrease in candle-power in a forward direction; while at an angle of less than 20 degrees, the negative flame is deflected first in one direction and then in another by the positive carbon, causing corresponding fluctuations in candle-power.

The average consumption of the car-

bons with this trim, when surges with a peak current of 270 amperes were timed to occur every other positive half-cycle of a 96-cycle source, is 13 inches per hour for the positive carbon and 11 inches per hour for the negative carbon.

The appearance of the intermittent arc employing this trim is indicated by the photographs of Fig. 4. The first five photographs are side views of the arc, and give the appearance of the arc (*a*) just before the active half-cycle (—10 degrees); (*b*) at the start of the current surge (30 degrees); (*c*) at the peak surge current (90 degrees); (*d*) as the current is dying away (160 degrees); and (*e*) after the end of the conducting half-cycle (200 degrees).

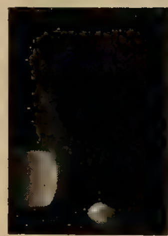
All pictures were made with the same exposure time, employing a specially constructed synchronous shutter whose opening could be adjusted in phase along the time-cycle events.

The last three photographs show the front view of the positive crater: (*f*) before the start of the conducting half-cycle (—20 degrees); (*g*) at the peak current (90 degrees); and (*h*) after the end of the half-cycle (210 degrees). The photographic exposure is the same in all three of these pictures.

(*a*) before surge starts. (—10°)

(*b*) As surge starts. (30°)

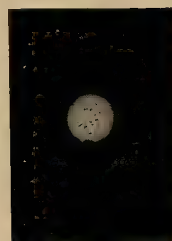
(*c*) At surge peak. (90°)



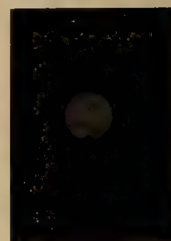
(*d*) Near cut-off. (160°)

(*e*) After cut-off. (200°)

(*f*) Before surge starts. (—20°)



(*g*) At surge peak. (90°)



(*h*) After cut-off. (210°)

FIGURE 4

Photographs of the intermittent carbon arc at various phase-angles: 7-mm "Suprex" positive carbon; 270-ampere peak surge current (electrical degrees given beneath pictures refer to zero at beginning of surge half-cycle).

Intrinsic Brilliancy Data

One of the most interesting characteristics of the intermittent arc is that it is possible to obtain much higher momentary values of intrinsic brilliancy and candle-power than can be obtained with the same carbons operating on D. C. The 7-mm "Suprex" carbon at 50 amperes' D. C. produces 12,000 candle-power and a brilliancy of 600 candles per sq-mm. This same carbon, operated intermittently from a 60-cycle source and flashing the arc every fourth half-cycle, gives a peak candle-power of 70,000 to 75,000 and a peak brilliancy of 1350 candles per sq-mm. at a peak current of 350 amperes. Flashing much less frequently, a maximum brilliancy of 1600 candles per sq-mm. can be obtained from this carbon using a 675-ampere peak current.

The average light emitted during a light-pulse was measured by a photocell limiting the light reaching the active surface to a half-cycle by means of a sector opening in a synchronously driven disk placed in front of the cell. Measured in this way, the trim shown in Fig. 4 has an average candle-power of 26,000 during the surge half-cycle. During the first half-cycle of the inactive period between surges, the average candle-power is 3100, or 12 per cent of the candle-power during the current surge.

The candle-power during the second and third half-cycles following the surge is 2400 and 2200, 9 per cent and 8 per cent, respectively, of the average surge candle-power. The brilliancy during the active half-cycle averages 660 candles per sq-mm., while the brilliancy during the succeeding three inactive half-cycles is 20, 12, and 10 per cent of this, respectively.

When a sustaining current is used, the light between surges is still greater. The time-interval between current surges is evidently too short to allow the carbons to cool below incandescence; and since, with zero current between surges, re-ignition depends upon maintaining ionization during the inactive period, this is obviously an inherent characteristic of the intermittent arc on such a time-cycle of operation.

A test of the intermittent arc in an optical system was made, using a 14-inch Fresnel lens. The lens had a focal length of 14 inches and was placed 10½ inches from the crater. At this distance the lens picks up a 70-degree cone of light from the positive carbon and projects a beam having an angular spread of 20 degrees. During the active half-cycle, a quantity of light equal to 88 lumen-seconds was projected in the beam per light-pulse. The light projected during the succeeding three inactive half-cycles was 14, 10, and 9 per cent of this, respectively.

These measurements of the light radiated during the inactive, or dark half-cycles, as well as the photographs of Fig. 4, indicate that the carbons do not cool to a very great extent between surges at the frequency employed in these experiments. Although this "thermal lag" is of use in permitting the re-establishment of the arc after short periods with no sustaining current, it seriously reduces the efficiency of the intermittent arc in comparison with a D. C. arc with a shutter when the duration of the light-pulses is of the same order of magnitude as the time between pulses.

Comparisons made between the intermittent arc of Fig. 4 and an 11-mm., high-intensity D. C. arc with a shutter

giving the same light-cycle produced the following result. Considering only the surge-light of the intermittent arc and the light passed by the shutter from the D. C. arc, the intermittent arc was 1.6 times as efficient as the shuttered D. C. arc in terms of candle-power-hours per watt-hour.

Efficiency Considerations

Since current flowed only one-fourth of the time for the intermittent arc, a 4:1 instead of a 1.6:1 advantage over the continuous arc might have been anticipated, since three-fourths of the light generated in the latter case is wasted. That this did not prove to be the case is due to the thermal lag of the intermittent arc, which causes it to radiate energy between flashes.

The basis for expecting a 4:1 efficiency advantage for the intermittent arc over the shuttered D. C. arc in this service depends upon obtaining the same instantaneous light for a given instantaneous current through the arc in both cases. This implies that the light is directly produced by the current. However, conditions in the arc which determine the production of light are essentially thermal in character, and the same atomic and molecular processes would take place, giving the same light, if the carbons and their associated gases were heated to the same temperature by any means whatsoever. Electrical means is ordinarily used for this heating, because it is most convenient.

Light production, then, is a result of the temperature and its distribution, in an atmosphere provided by the controlled evaporation of core material from the positive carbon; there is no other connection between current and light.

In operation, heat is lost from the arc by radiation, convection, and conduction along the carbons at a rate depending upon the temperature of the various parts. These losses must be supplied by the current input in order to maintain the arc at a temperature suitable for light emission and for the evaporation of sufficient flame material.

Calculations based upon radiation theory indicate that a black body at the temperature of the carbon electrodes during the active period of the intermittent arc will continue to lose radiant energy at substantially the same rate during the idle interval between flashes for the time-cycle just described. This is confirmed both by the photographs of Fig. 4 and by actual measurements of electrode temperature *vs.* time taken optically with a synchronous shutter.

If the heat losses from the intermittent arc could be confined to the surge periods, then the anticipated efficiency advantage over a shuttered D. C. source would be realized. However, the losses do continue during the intermediate periods, and at almost the same rate as during the surge periods. Consequently, in order to maintain the required tem-

perature when wanted, additional energy must be supplied during the surge period to overcome these losses.

These remarks apply, of course, only to those applications where the time between light-surges is very short, as in both motion picture projection and the special photography application discussed. It is believed that they will apply to any situation in which the time between flashes is short enough to permit restriking without a maintaining current.

As the time between flashes increases, however, the potential economy of the intermittent arc increases at a rapid rate, so that if and when such applications arise, the intermittent carbon arc may find commercial utility. In the meantime, it has provided a most interesting means for the advancement of fundamental arc theory.

SEE SIX COMMERCIAL TELE STATIONS BY SEPT. 1

Minimum of six television stations are expected to be operating under commercial licenses by Sept. 1. By Jan. 1, total will be up to 10, it is expected. Latest to apply for a commercial television station was the Don Leė System, which tendered its application to the FCC requesting a construction permit for Hollywood.

Outlook for the new video-audio medium has become more optimistic each week, with the two New York outlets—WNBT, only station now operating on a commercial basis, and owned by NBC, and the CBS experimental outlet, WCBW—receiving considerable attention from the advertising agencies.

From a commercial standpoint, billings to date have far exceeded original expectations, it was reported at NBC. Signing of Adam Hats, and contracts with two new firms which are expected to be signed during the coming week, plus the spot telecasts seen under commercial sponsorship by Bulova, Procter & Gamble, Lever Bros., *etc.*, have indicated that the advertisers will assist telecasters to underwrite some of the costs in the early stages of development.

NAVY 'E' TO BAUSCH & LOMB FOR FINE DEFENSE JOB

Seven thousand employees of Bausch & Lomb Optical Co., who produce most of the "eyes" for national defense, recently were accorded the unprecedented right to wear the Navy's coveted "E"—a U. S. Navy insignia which means "well done." And the big Rochester optical plant, where more than 50% of the fire-control equipment for the nation's armed forces is produced, became one of the first 14 in the entire nation entitled to hoist the blue, red and yellow flag of the Naval Ordnance Bureau.

It was pointed out that more than 85% of the total Bausch & Lomb instrumental output now is devoted to defense. The B. & L. management expressed its appreciation of this coveted honor by telegraphing personal congratulations to each of its 7000 employees, those who "made possible this miracle of industrial production."

G. T. E. EARNINGS INCREASE

General Theatres Equipment and subsidiaries, excluding Cinema Building Corp., report for the three months ended June 30, 1941, a net profit of $258,014 after provision for depreciation and for estimated Federal income and excess profits taxes. This compares with net profit of $195,637 for the corresponding quarter last year.

The deduction for Federal taxes in the second quarter includes provision for estimated normal tax of $111,825 and for excess profits tax of $19,428, both at the prevailing rates, and a reserve for possible additional normal and excess profits taxes of $100,000.

As of June 30, 1941 G.T.E. had 585,752 shares of capital stock outstanding, compared with 592,497 shares a year ago.

TECHNICOLOR SCORES GAINS

Productions in Technicolor are currently at a new numerical high, with seven top-bracket features before the cameras or in other stages of preparation, in addition to several short subjects, according to Dr. Herbert T. Kalmus, company's president.

Dr. Kalmus said that his organization "is aiming at an aggregate of 100,000,000 feet in prints" during 1941, which will represent a sharp rise from the 80.000,000 feet achieved in 1940, the former high-water mark of Technicolor's steady advance during the past decade.

Monopack (single negative), he stated, is not yet ready to be offered generally, but is gradually being used on an experimental, semi-commercial basis on the Coast.

RCA Theatre-Television Technical Data

By *I. G. MALOFF* and *W. A. TOLSON*

MEMBERS OF THE TECHNICAL STAFF, RCA RESEARCH LABORATORIES

In this short resume of RCA's theatre-television system the most pertinent factors of the development are presented and some of the problems stated. In addition to a review of television experiences of the past there is also included a description of the RCA theatre-television system recently demonstrated in New York City.

THE problem of theatre television is essentially that of providing a bright picture on a viewing screen of normal theatre size, this picture having adequate resolution, contrast, and freedom from distortions. The question of how much light is needed on a theatre projection screen has been studied in the past by the S.M.P.E., a committee of which recommended[1] a temporary screen-highlight-brightness standard of from 7 to 14 ft.-lamberts.

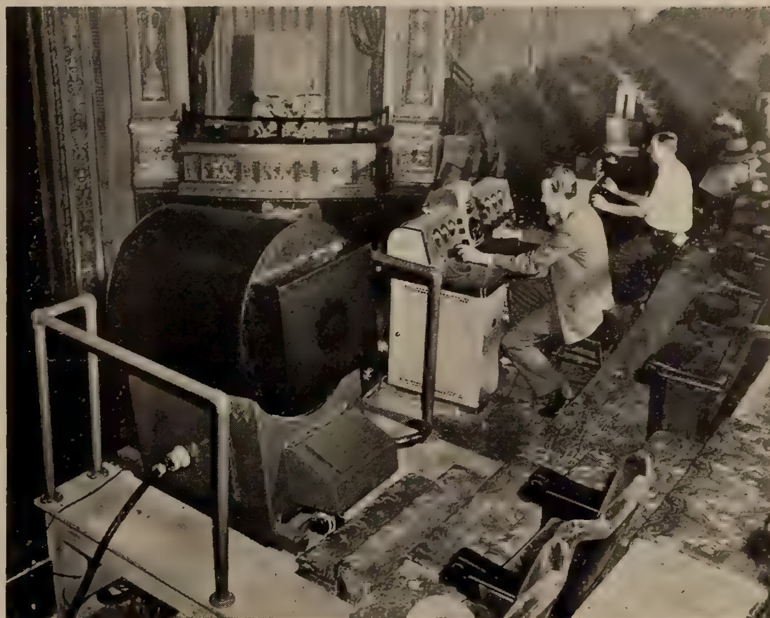


FIGURE 2. ***Theatre-television projection units in balcony.***

The S.M.P.E. proposed a screen-brightness standard for the purpose of making it possible to print all the release films to the same degree of contrast [gamma] and to avoid making prints of different contrast for theatres with different screen brightnesses.

So far as visual satisfaction and avoidance of eye fatigue are concerned, the range of acceptable brightness appears to be much wider than the recommended standard. Values of screen illumination from about 1.5 to 20 ft.-candles have been regarded as satisfactory at one time or the other.[2] With the wide-angle screens used in most theatres, this is nearly equivalent to 1.5 to 20 foot-lamberts in screen brightness. From information available on deluxe motion picture theatres it appears that the screen-brightness varies between 5 and 22 ft.-lamberts.

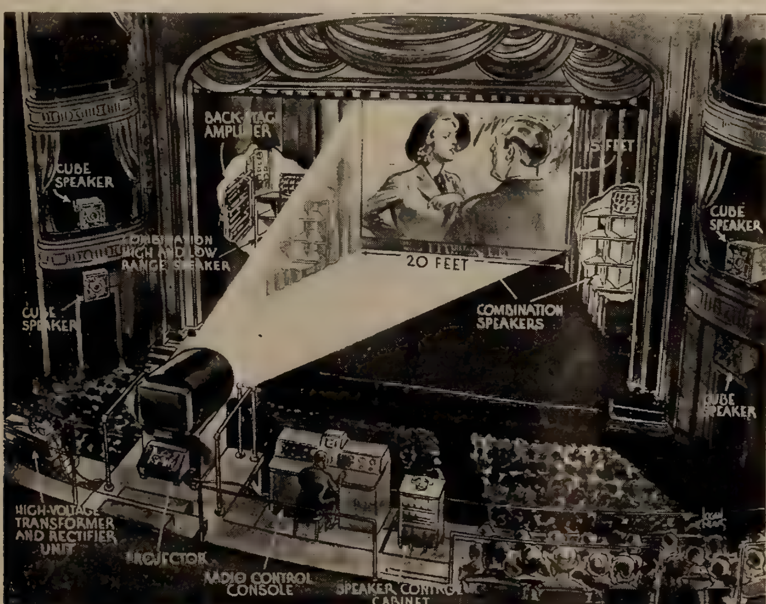


FIGURE 1. ***Sketch of theatre-television installation.***

In television, due to its flexibility in contrast and levels, motion-picture standards need not be adhered to, but it is reasonable to conclude that in theatre-television pictures the limiting high-light brightness should be at least of the order of the lowest value encountered in good motion-picture houses, a value which is about 5 foot-lamberts.

Screen Lighting Requisites

In a television-projection system the luminous image originates on the screen of a cathode-ray tube. This screen radiates light nearly as a perfectly diffusing (wide angle) surface. To project the image on the viewing screen some sort of an optical projection system is required. It has been shown[3] that in projecting the light from a perfectly diffusing surface on to a viewing screen by means of a conventional lens, much of the light is lost. In fact (for large magnifications) the following relation exists:

$$\frac{\text{(lumens on screen)}}{\text{(lumens on tube)}} \, 100 \text{ per cent} = K \frac{1}{4F^2} \times 100 \text{ per cent}$$

where K is the transmission of the lens

and F is the f number of the lens. Good, commercially available, projection lenses, having a maximum numerical aperture of $f/2$ transmission about 60 per cent of maximum, collect from the tube and deliver to the viewing screen only 3¾ per cent of the light generated.

For a 15- by 20-foot wide-angle theatre screen (300 square feet) having 5 ft.-lamberts maximum brightness, about 1500 lumens maximum of incident light is required. By wide-angle screen is meant a screen producing approximately 1 ft.-lambert brightness for 1 ft.-candle or 1 lumen per square foot of incident illumination. Narrow-angle directional screens produce as high as 5 foot-lamberts brightness for 1 ft.-candle illumination. At 3¾ per cent efficiency this calls for the staggering figure of 40,000 lumens, or 12,700 candlepower, on the face of the cathode-ray tube.

Experiences of the Past

On the basis of the foregoing discussion, the problems of theatre television may be resolved into the following:

(1) The problem of providing the most efficient optical system so as to utilize the largest possible percentage of the light generated.

(2) The problem of obtaining sufficient candlepower per unit area of the luminescent screen, by means of increased operating currents and voltages.

(3) The problem of providing a design of cathode-ray tube capable of operating at high currents and voltages.

(4) The problem of providing adequate accessories, such as deflecting circuits, video and power supplies, as well as providing adequate safety for viewers and the operating personnel from the high voltage and X-rays generated.

The basic aim of the RCA television-research program from the beginning has been twofold: (1) to develop apparatus for home-television service; and (2) to develop apparatus for theatre-television service. Even in the early stages of this program it was evident that while the first item could be accomplished with the aid of either the direct viewing or the projection system, the answer to the second item could be obtained only by a projection system. Therefore, the two systems—direct viewing and projection—have been carried along side-by-side, each benefiting from the other on the way.

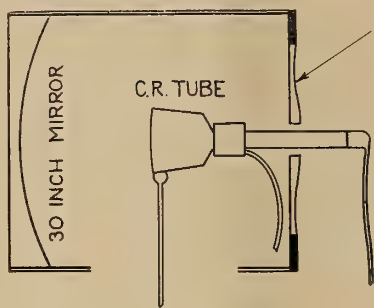


FIGURE 3

Schematic of reflective-projection optics showing location of cathode-ray tube.

The first public showing of a theatre-television system was made by RCA in New York City on May 7, 1940, a projected-television picture 4½ by 6 feet in size with brightness well above the 5 ft.-lambert value. The same system was shown informally to members of the F.C.C. on February 5, 1940 in Camden, N. J.

The experience with the development, construction, and operation of the system giving a projected picture 4½ by 6 feet in size with adequate brightness, definition, and freedom from distortions indicated that the answers to the problems stated earlier in this article had been found. The next obvious step was to build a system for a full-size theatre screen. This was done and on May 9, 1941, a demonstration of such a system, using a 441-line television signal and a projection screen 15 by 20 feet, was formally given before a large group of invited guests at the New Yorker Theatre in New York City. The program included was climaxed with a championship boxing bout. The general layout of the equipment is shown in Fig. 1.

All parts of the equipment used for the demonstration in the New Yorker Theatre were scaled up from the preceding system which gave the 4½ by 6-foot picture. In addition, a few improvements and refinements resulting from experiences gained in operating the smaller equipment were provided in the new unit. A photograph of the projector, control console, and sound-control cabinet in operation at the New Yorker Theatre is shown in Fig. 2.

Projection Optical System

From the beginning of the development, the problem of providing an efficient optical system appeared to be the most formidable. A few per cent improvement was of no interest. Many-fold increase in the percentage of light delivered to the screen was sought. The answer was found in a reflective optical system consisting of a spherical mirror and an aspherical lens. The principle, that aspherical surfaces of various shapes may be combined into optical systems of high apertures and free of spherical aberration and coma, has been known for some time.

RCA opticians applied this principle to a television-projection system. In its final form the optical system is arranged as shown in Fig. 3.

This system on actual tests showed 25 per cent optical efficiency; in other words, it delivered to the viewing screen 25 per cent of the light originating on the diffusing screen of the cathode-ray tube. The gain over the conventional $f/2$ optical system is therefore *seven-and-one-half-to-one.*

The problem of obtaining more candlepower by means of raising operating current and voltage has also been successfully solved. It was found that the thickness of the luminescent layer should increase with the operating voltages and optimum thickness was found for 60- to 70-kilovolt operation. Special provisions were worked out to avoid the so-called "sticking" effect.

The problem of designing a cathode-

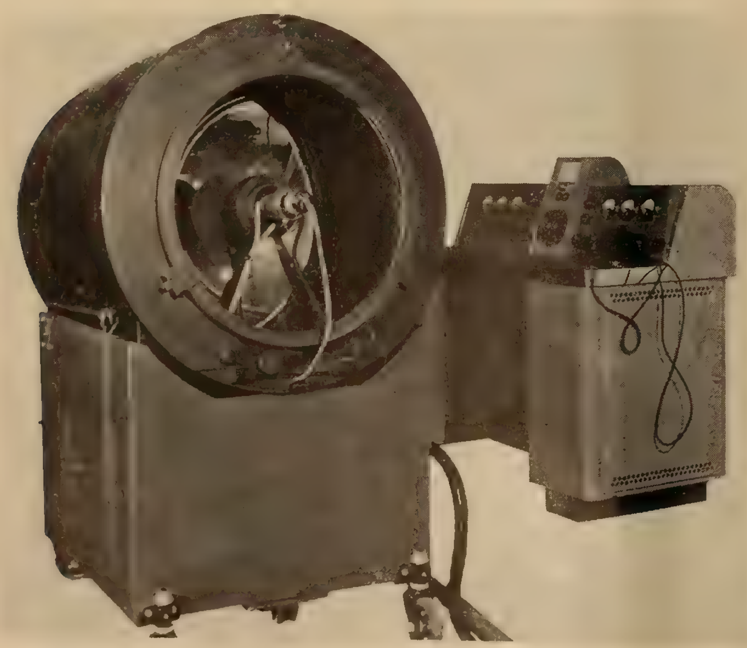


FIGURE 4. *Close-up view of the projector and control console.*

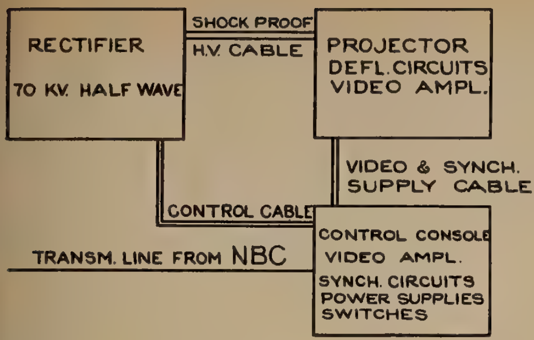


FIGURE 5

Block diagram of the theatre-television installation in the New Yorker Theatre, N. Y. City.

ray tube for reliable operation at 60- to 70 kilovolts was solved by introducing a new neck construction, now being identified as "double-neck" construction. The shape of electrodes had to be carefully selected and a number of refinements had to be introduced in the construction and processing of the tube. The general appearance of the tube mounted in the projector, and a close-up of the projector and control console, are shown in Fig. 4.

The design of the video amplifier, deflecting and synchronizing circuits, and power supplies in a projection equipment in which the cathode-ray tube is operated at 70,000 volts maximum offered new problems, as did also the mechanical arrangement of the equipment. Some of these problems were solved by simply increasing the capacity of the units which had been used on the lower-voltage equipment. Other problems required radical changes in design and operating technique. A block diagram of the complete installation is shown in Fig. 5.

Proper thicknesses of metal were chosen in the construction of the projector to insure complete safety from the X-rays generated by the high-voltage cathode rays. The installation was thoroughly checked under operating conditions to ascertain by actual measurements that the protection was adequate. Standard rules for protection from accidental contact with high voltage were followed.

The cathode-ray tube used in this installation is capable of delivering about 400 candlepower maximum of useful light. This is equivalent to about 1200 lumens. At 25 per cent optical efficiency this means 300 lumens delivered to the screen, producing 1 foot-candle illumination on the 15- by 20-ft. screen. With a five-to-one directional screen, a highlight brightness of 5 ft.-lamberts results. In actual demonstrations a compromised screen having directional gain of only two-to-one was used, giving a highlight brightness of slightly more than two ft.-lamberts.

References:

[1] Report of Projection-Screen Brightness Committee, *Journal S. M. P. E.* **XXVII** (Aug. 1936), p. 127.

[2] An analysis of Theatre and Screen Illumination Data, by S. K. Wolf, *Journal S.M.P.E.*, **XXVII** (Aug. 1936), p. 139.

[3] "Electron Optics in Television," by I. G. Maloff and D. W. Epstein, *McGraw-Hill*, New York, 1938.

Exhibitors Rediscover Poor-Print Evil

PROJECTIONISTS have long been aware of the prevalence of poor-quality prints, but to see the exhibitor journals, after being jacked up by letters from irate subscribers, yell about this topic is a sight indeed. Leading the parade with some pretty frank comment anent prints has been *Boxoffice*, and it is to editor "Red" Kann thereof that we are indebted for permission to reprint excerpts from a statement by Michael Freedman, of American Recono, Inc. Here they are:

"As an exhibitor and laboratory man, I wish to assure you that fine-grain film will not correct the condition complained of. Why does Paramount feed you bunk about spending large sums of money to turn out fine-grain prints, instead of supplying the real answer to the problem?

"Fine-grain prints are being turned out by commercial laboratories at no greater cost than standard prints. 'Citizen Kane' prints were made by De Luxe Laboratories. There is absolutely no additional expense involved on the part of the studio. Laboratories have spent a moderate sum of money adapting their printers to handle the slow emulsion used in fine-grain positives.

"This industry is the only industry that does not pay proper attention to the packaging of its merchandise. Can you imagine General Foods or any other manufacturer of packaged merchandise sending dirty, marred packages to the small grocery stores, and perfect, clean, unblemished packages to the large chain outlets?

"The screen (quality of print and projection) being the package containing the film story is as important to the industry as the package is to the food, cigarette and other packaged-goods industries. The studio makes a great effort to obtain beautiful pictorial effects, and the laboratories turn out perfect copies; but once the goods leave the factory the industry progressively begins to lose interest in the quality of its packaging.

"The distributors' excuse that they supply poor-quality prints to subsequent-run houses because of the small rentals paid is a perversion of the truth. In most cases the subsequent-run house is paying a higher rate that the first-run, based on the percentage of film rental to receipts. This is a poor argument to give a patron who has been persuaded to shell out his good money by the alluring ads used by producers and first-run houses.

"Mr. and Mrs. Patron expect the same first-class quality of packaging even though it be a bit late in coming to their favorite theatre.

"There should be no place for an economy, for any policy, that does not result in all the moviegoers being left with the impression that the screen is a thing of beauty. The remedies are at hand—they need only be applied conscientiously.

"Articles by yourself and others express true conditions that are general throughout the industry, but which unfortunately make no impression on the top men."

Characteristics of New-Type Dry Cells

DRY cells and dry cell batteries recently placed on the market incorporate a new trick—a manufacturing innovation—which requires increased care on the part of the projectionist using them. Complete chemical details are not available, but while the new batteries should have longer life, and particularly longer shelf life, the improvement directed toward that end also increases their ability to occasion corrosion when they wear out.

Such cells are normally filled with a solution of sal ammoniac—ammonium chloride. They are never dry, of course. In the past this solution was in the form of a thick white paste. As most projectionists know, the zinc casing of old cells sometimes gives way under the corrosive action of this paste, which then leaks out, corroding almost any object with which it comes in contact, including almost all metals, cloth or paper insulation, *etc.*

Extent of Improvement

Although sal ammoniac has a powerful affinity for water and will absorb it from the air on a damp day, it does in some climates and under some conditions dry up. This is one reason for the limited shelf life of dry cells. Despite a "moisture-proof" seal, and despite the hygroscopic nature of the material inside, the water evaporates very slowly. Similarly, the corrosive effect of any paste that leaks out is limited under conditions in which the paste dries up. *Dry* sal ammoniac is inactive.

The recent improvement noted in some cells now being sold apparently consists of addition of a second water-attracting, water-holding substance, such as glycerine or one of the glycols. These liquids do not dry up, and they will keep sal ammoniac damp under conditions in which, mixed with water only, it might dry. Cell manufacturers queried refused detailed information; but at any rate the new cell-filling compound definitely does not dry under conditions in which the old type does.

An improvement in battery shelf life is apparently the intention of the innovation found in the cells examined. By the same token, however, there will be increased permanence of corrosive power in any of the material that succeeds in eating through the zinc case.

Projectionists should be doubly careful to examine at frequent intervals all dry cells wherever used, whether in amplifiers, ohmmeters or only flashlights, to make sure that any which corrode through are thrown out immediately. Spares on the shelf should also be watched, because corrosion material from one will certainly attack the zinc cases of its neighbors.

The new material presents the appearance of a translucent, oily liquid, or a very thin white vaseline. It can be washed away with plenty of water. After the last trace of the paste is definitely removed, the water remaining can be dried off quickly, if desirable, by following with a washing of alcohol. The water and alcohol will evaporate together with great rapidity.

Sound System Data—For Mr. Manager, Too

THERE is ample justification for the recent action of the Research Council of the Academy in recommending increased amplifier output power for theatre sound systems. These recommendations call for output powers considerably in excess of that available in most present-day sound systems, and particularly so in sound systems installed years ago.

This observation is buttressed by the experiences which service inspectors are continually running up against. For instance, a New York theatre called for an engineer reporting that "meters are jumpy". On arrival I found the plate current meters of the amplifiers were fluctuating badly. This generally is a sure indication that the amplifier is overloading.

The reason for the overloading in this case was operation of the amplifier at excessive volume in an effort to adequately handle a large and rather noisy audience. Human bodies absorb sound, thus the larger the audience the greater the sound absorption. When an auditorium is crowded, with standing-room taken, the absorption often becomes so great that it is necessary to operate the volume control two, or three, or four, or even more steps higher than with a small audience in an attempt to obtain enough volume to adequately cover the house.

As the volume control is raised the gain of the system is increased, and the amplifiers, usually the final amplifier, approaches its overload point. When the overload point is reached, the plate meters fluctuate and the sound commences to "break" and becomes disagreeable.

Another factor contributing to the need for larger amplifier output power where packed audiences are involved, is the effect of the audience noise level. The larger the audience, the larger the level of background audience noises, such as coughing, murmuring, movement in seats, *etc.* It is necessary to raise the sound volume still further and therefore run the danger of overloading in order to compensate for and drown out this audience background noise.—F. E. Fetig, *ALTEC, Hillside Park, N. J.*

UNIQUE PROJECTION SETUP AIDS MACHINE TOOL INDUSTRY

An invention which would permit the operator, by a mere glance at an image on a projection screen mounted on the machine tool, to tell whether the machine is set to perform accurately won U. S. Patent 2,249,121.

Heretofore, the patent explains, in checking the accuracy of a forming tool, the material being machined was set in approximately the proper position with respect to the tool, a part of the work piece was cut, and the operations of setting and cutting repeated until the work piece was properly set.

In the new setting checker a projector similar to that used for lantern slides, is used. A projection screen is mounted near the machine tool. On the screen is represented in profile and at predetermined magnification the size and contour to which the work piece is to be cut or machined. By means of a light and lens an image of the drill or grinder is projected on the screen in a position with respect to the profile on the screen that corresponds to the position of the tool with respect to the work piece.

In this way the operator need merely look at the screen to tell whether the tool is in proper cutting or grinding position and performing its work accurately. He can thus follow all the motions of the tool.

The patent is assigned to Bausch & Lomb Optical Company.

EXHIBITOR EQUIPMENT POOL

Independent exhibitor film-buying combines are not new, but a new twist to this old idea has been given by a group of Nova Scotia exhibitors who have agreed to purchase all theatre equipment exclusively through a cooperative theatre group. No indication has been forthcoming as yet from manufacturers and supply dealers as to their reaction to the proposal.

W. P. Stone, projectionist for the White Amusement Co., of Asheboro, N. C., has been elected and installed as a member of the Board of Education of that city. (No, Mr. Stone didn't use special trailers on his screen while campaigning.)

DISNEY STUDIO STRIKE ENDS

Four hundred Walt Disney Studio workers, having won a closed shop and union recognition, have returned to work pending arbitration of wages and working conditions. Commissioner Dewey, representing the Government, Walt Disney and Screen Cartoonists Guild representatives will continue to meet on these points.

Theatre picket lines in various cities will be withdrawn and the limited boycott on Disney pictures lifted.

LAEMMLE, SR., WILL PROBATED

Los Angeles probate court recently appraised the real and personal estate of the late Carl Laemmle, founder of Universal pictures, at $2,518,908. Included in the estimate were stocks in many film and other corporations, Hollywood business properties and a home and other real estate valued at $150,000. A will, probated following Mr. Laemmle's death in 1939, left the bulk of the estate to his son Carl, Jr., and a daughter.

IP AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

THIS is a lecture on the evils of too many well-meaning "sound experts" crowding the projection room when a sound breakdown occurs. At such a time the projectionist and the service inspector have their hands full and a "No Admittance" sign should definitely be hung on the projection room door; a polite "Please do not Disturb" is insufficiently persuasive.

One of my theatres had to make admission refunds of several hundred dollars largely because of the lavish advice and muddling of electronic hobbyists who had no right to be in the projection room. Probably there would have been no admission refund if the projectionists had been left alone. Temporary correction might have been effected and the show continued until the serviceman arrived.

Theatre managers *and others* should take this matter seriously. Equipment breakdown in the projection room should not be considered as a signal for everybody to crowd in. The projectionist and the service inspector are best fitted to handle an emergency situation and one can rely upon it that they will do much more than any of the multitude of "cooks" who usually swarm in and spoil the "broth". For some unknown reason it seems that it always is these "cooks" who more or less take over the place.

Smart theatre managers will follow the rule, in case of projection room trouble, to get in touch with the projectionist on the job and arrange for such assistance or parts as may be required. Beyond that, the theatre manager should keep *everybody out*.—A. H. Hosier, *ALTEC, Edwardsville, Ill.*

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Caps on film cement bottles often stick to the bottle, tearing the paper or foil seals out. To prevent this, "Tex," the projectionist at the Lincoln, Stockton, Calif., has melted a few drops of paraffin into the cap. Result: no more sticky caps and longer life from the cement. —H. E. Bearden, *RCA, San Francisco.*

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Recently I encountered a case of microphonic trouble on a W.E. Type 208 installation. On one machine the gear noise, *etc.*, was quite noticeable whenever the fader was turned up very far; while the other machine was okay. Various remedies had been tried, and interchanging the photocells and exciter lamps between machines did not improve the trouble.

It was noticed that the bronze spring which holds the photocell in place was stronger on the noisy machine. By changing the shape and tension of this spring to correspond to the one in the quiet machine, the trouble was eliminated.—B. D. Douglass, *RCA, Kansas City, Mo.*

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This is an old one, but it bears repeating. In case you are disturbed by rattling noises occurring on certain frequencies during sound reproduction, check those horn chains. The best cure for horn chains which resonate at certain frequencies is to wrap them up thoroughly with a half-dozen rolls of friction tape.—R. Siegel, *ALTEC, Brooklyn, N. Y.*

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When a motor is dismantled for cleaning or the replacement of internal parts, great care should be taken in re-assembling it to see that the internal wiring or leads to brush holders or centrifugal switch are positioned so that there is no danger of such wiring striking the rotor after assembly. If this is not done, the constant rubbing of the rotor against the wiring will in time wear through the insulation of the wiring and cause a ground.

This fact is borne out by the number of emergency calls which service inspectors have to answer and the number of shows that are shut down by grounding of motor wiring.—J. B. Pesek, *ALTEC, Chicago.*

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Recently I answered an emergency call which reported poor quality, low volume and loss of high frequencies, all on one machine. The projectionist had replaced all vacuum tubes, checked resistors, cleaned the lenses and photo-electric cells, *etc.*, with no avail.

I found that the volume was low as reported and quality was poor not only due to loss of high frequencies but also because of pronounced flutter. The cause was traced to caked emulsion and wax on the sound aperture plate. This cake of spurious material was so smoothly applied to the aperture plate that it was hardly visible and could not be removed by ordinary cleaning methods such as had been applied in the first attempts to correct the trouble.

What was happening was this: The sound track was being displaced from its normal plane, which introduced losses, affecting both loss of volume and high frequencies. The flutter was probably due to either the film not being held flat against the aperture plate or irregular motion caused by the friction of the caked emulsion and wax.—E. W. Hoeft, *ALTEC, Milwaukee.*

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WHILE catching up on my reading, I ran across in I.P. the article by E. J. Doolittle (March, 1941) regarding speaker failure due to volume overload. The trouble encountered by this engineer brought to mind a trying experience encountered about two years ago.

Within the space of two months, one theatre had to replace eight Type 555 receivers. Checks were made of the equipment, but no faults were found. It was thought advisable to check for possible "shorts" from speaker circuits to lighting circuits; but when done this revealed nothing extraordinary. Incidentally, one case of "shorted" speaker units investigated a year previous had been found to be due to a grounded 220-volt circuit crossing up with the voice coil lines.

To get back to the receiver failure under discussion, the cause was found quite by accident. While checking the theatre equipment just before a show, it was noticed that the Type 43 amplifier was overloading badly, while connected to the non-synch which was in operation. Volume in the auditorium appeared normal, but further investigation revealed two things:

First, the theatre had become the proud possessor of a new and heavier plush stage curtain. Second, the old perforated screen had been replaced with an inferior porous-type sound screen. Together, these replacements had resulted in an apparent decrease in auditorium volume, particularly when the non-synch was being played. This required a step-up in the volume setting

of the non-synch to a point more than sufficient to overload the power amplifiers. Unfortunately, this was not noticed by the projectionist, and the excessive signals were passed on to the receivers. Every peak signal from the records would contribute its bit to the exit of the receivers.

The trouble was eliminated by means of explicit instructions regarding volume level of the non-synch. No further receiver failures were noted from this cause. As a matter of record, the horns in use were of the Type 12 variety giving a good loading to the receivers. At overload point, the volume from the horns was tremendous as heard backstage. But no one had been back-stage during the trouble period to observe the excessive volume.—C. E. WHITE, *RCA, New Orleans.*

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A length of single shielded microphone cable long enough to reach from the p.l. cell compartment of one machine to the other, and with a small insulated battery clip at each end, is a handy gadget to have around to interconnect the output of both soundheads should trouble develop in one of the 49' amplifiers.—A. H. KNIGHTS, *RCA, New York.*

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Only one thing will cause a hum like a mosquito and that is a mosquito. With sound system hum it's different. An endless variety of conditions may upset the modern high-gain sound system and cause it to pick up stray hum from the house wiring or associated electrical equipment.

Several weeks ago I had a trouble call concerning hum which at first was thought to be caused by the slides on the light gate assembly. Replacement of the slides failed to correct the trouble. What I found was a solder lug on the arc lamp which was not sufficiently taped. The shoulder of the lug just barely came in contact with the base of the machine, the contact being of high enough resistance as not to interfere with the arc light, but still of sufficient resistance to allow enough current leakage to cause an objectionable hum in the system. Taping up the lug eliminated the hum.—I. E. RICE, *ALTEC, Charleston, W. Va.*

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With the advent of hot weather, all failures of electrical parts zoom upward because practically all of such parts generate heat when in operation, and as the ambient temperature increases their ability to radiate and relieve themselves of this heat is curtailed.

The part of the sound system most subject to "heat prostration" is the filter condenser. These are the condensers on the output of the power transformer just beyond the rectifier tube. They are operated at high voltages, generally running from 400 to 1000 volts. Any weakening of the dielectric caused by heat may lead to a short-circuit and a closed show.

Be sure that you are well acquainted with the location of the filter condensers in your amplifier. Have your service inspector point out which ones are most apt to fail. Familiarize yourself with any emergency "cut-out loops," which are designed to permit cutting-out rapidly one or the other side of a bank of filter condensers in case of failure. Practically all W.E. amplifiers have been modified with "cut-out loops" and tagged with instructions for their operation.

Another thing: keep that projection room as cool as possible. It won't do any harm to direct an electric fan on

the power amplifier during hot days. Do everything possible to promote ventilation and the movement of air around and through the amplifier. These homely precautions may save you a breakdown on a hot summer day and save the manager the heartache of admission refunds.—H. M. STEELE, *ALTEC, Baldwin, L. I., N. Y.*

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THE projectionist should make out a list of troubles experienced between service calls. This will assist the sound engineer considerably, as otherwise the cause may be overlooked. Parts required should also be listed so that they will be ordered and not overlooked.

In case of trouble with the sound system, particular care should be taken to localize the difficulty. Suppose that the sound fails while running one machine. In case the other soundhead reproduces okay, it hardly calls for a complete change of main amplifier tubes. As obvious as this may seem, I have seen more than one similar case where all main amplifier tubes were changed.

Almost every projection room has a non-sync attachment. If the sound should fail, it should be used just for a second to act as a check on the amplifier. If the quality and quantity is up to normal after checking the non-sync, it naturally follows that the amplifier is okay from the point of input of that signal to the speakers. This simple check will eliminate many "ifs" and may assist the engineer in helping to clear the trouble *via* telephone.

Suppose you are experiencing pronounced hum. Turn the volume control or fader down to zero for a second. Does that stop the hum? If it does, it will be self-evident that the trouble is introduced *before* and not after the signal meets the control.—M. W. GIESKIENG, *RCA, Denver.*

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Here is a trouble cause to store away in the back of your mind for checking when everything else seems to fail.

One of my theatres reported bad background noise. The noise was of low frequency occurring at various intervals. Investigation disclosed that the A.C. voltage to the power unit would rise and fall sharply, causing a like fluctuation in the D.C. output to the pre-amplifier filaments. By beginning at one end of the system and tracing through, the cause was finally located in a 60-ampere cartridge fuse way down in the basement of the theatre. The fuse was making poor contact in its clip. Intermittently the poor contact would arc, which caused the voltage of the power unit to take a nose-dive, thus producing noise in the system.—E. J. TOWNSEND, *ALTEC, Garden City, N. Y.*

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It's funny how defects developing in arc lamp circuits are such a common cause of hums being picked up in the sound system. Recently I had a case of an illuminating lamp in a lamphouse becoming grounded which introduced the inevitable hum into the sound system. —H. L. NEUERT, *ALTEC, Toledo.*

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The following is a copy verbatim of an Emergency Call Report which has further bearing on the theme "Know Your Fuses." The theatre had reported that the #1 arc generator was not working and a local electrician had been called.

"#1 generator is used for #2 spot lamp during stage show only. #2 generator was working o.k., and supplies current to either picture lamps or #1 spot machine.

"#1 generator had started and ran o.k. for a few minutes, then stopped of its own accord. When started, the output D.C. polarity had reversed itself. Projectionists finished stage show on one spot lamp and started the picture performance. When changeover was made from #2 to #1 machine, no light could be had to #1 machine, and #2 generator stopped. This happened several times, and all of the foregoing before Inspector was called.

"Tests on lamp and wiring to #1 lamp showed everything clear of shorts and grounds. Further checks showed that considerable confusion prevailed as to where fuses were to go for each spot and lamp. When this was straightened out,

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the #2 generator allowed the show to continue for the picture and #1 spot. It developed that fuses were being put in a block which should be left open and unfused. Fusing of this block causes the output of the two generators to be paralleled. Since the polarity was opposite on each, considerable fireworks and fuse popping occurred.

"How Cleared: The #1 M.G. set was operating o.k. except for reversed polarity, therefore, the output to the #2 spot and meters was reversed. Operation was satisfactory after this change."—A. D. BROOKS, *ALTEC, Silver Springs, Md.*

It's a boy, John Joseph McKeon 3rd, at the home of the J. J. McKeon's of Altec Service's accounting department.

Drive on Outdoor Movies is Hit by Indiana Ruling

Union efforts to impose restrictions on the numerous itinerant picture shows, utilizing portable projection equipment, received a severe setback as a result of a decision by the Indiana Attorney General that such entertainment is not within the provisions of the 1937 law licensing and regulating motion picture theatres.

The opinion, given to Clem Smith, State Fire Marshal, asserts the 1937 law's intent is to regulate structures as a safety measure and that fees are established on the size and capacity of building.

The Attorney General pointed out that in many cases outdoor movies are free and are sponsored by merchants in the communities in which they are shown and that it would be difficult to fix a license fee on an audience capacity basis.

All Loew's N. Y. Theatres Go to Altec Service

Marking one of the most far-reaching realignments in the sound servicing field in recent picture business history, Loew's, Inc., has appointed Altec Service Corp. to service the entire Loew's metropolitan New York circuit of 75 theatres, effective August 1. This action brings the total number of Loew's houses under Altec service contracts to 105. Bert Sanford negotiated for Altec.

L. U. EDUCATIONAL PROGRAM

I. A. Local 273, New Haven, Conn., projectionists, has established a new education department with the aim of informing members on all new sound and visual projection developments. Edward W. Bopper was appointed chairman, with Warner sound engineers C. P. O'Toole and Donald Collins, Fred J. Pfeiff of Altec, and Myron Wheaton, of RCA, serving on the committee.

LOEW'S 40-WEEK EARNINGS

Loew's, Inc., parent of the Loew-Metro production-distribution-exhibition companies, earned a net profit of $7,206,466 for the 40 weeks ended June 5th. The sum is subject to reserve "on account of such foreign funds as may be restricted, and to a year-end audit." For the 40 weeks ended June 6th of 1940, the company had a net profit, subject to the same qualification, of $7,996,394.

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Monthly Chat

NO greater responsibility devolves upon projectionists than to protest individually and collectively against the current "investigation" of the motion picture industry by a Senatorial subcommittee now in progress in Washington. This witch-hunt by a group of self-advertising isolationist senators should be deluged by a tidal wave of protest from projectionists in behalf of the industry of which they are integral part and from which they derive their livelihood. This is *your* industry, too, not just the industry of producers and exhibitors. Do it now!

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With printers being asked by O. P. M. to list the amount of metal for type slugs now on hand, as a guide, this will probably be the last effective warning that materials necessary for the production of theatre equipment are becoming more scarce daily. Those who think that the cry of shortages was raised by manufacturers and dealers merely as a buying stimulant will all too soon discover their error. Or would you prefer a darkened theatre?

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No word as yet from Los Angeles projectionist Local 150 anent the results of its questionnaire regarding the advisability of changing Standard Release Print specifications. We can appreciate the difficulties being encountered by Local 150's committee, particularly with respect to changeover markings and procedure, on which item there are almost as many "solutions" advanced as there are commentators.

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Incidentally, the materials shortage has slowed down television development to a walk. Instead of the booming market in home and theatre equipment that was anticipated for this Fall, television's sponsors have been forced to turn to promoting cuffo shows of styles and the like for the few thousand home sets available in an effort to keep alive the interest of potential advertisers. Thus, the theatre field is given a breathing spell before having to tussle with another technological upheaval.

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If these itinerant 16 mm. shows continue their present country-wide expansion rate, both the craft and their exhibitor employers are in for some severe financial headaches. These shows, frequently sponsored by groups of local merchants, can be stopped only by joint exhibitor-projectionist action, with the latter being able to deal some particularly heavy blows via the Central Union route.

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How is your stock of tube replacements? Of p. e. cells? Of tungar bulbs? Even the studios are fearful of a shortage of electronic products, so where does this leave the non-affiliated lone theatre?

MONDAY, JULY 14, 1941

NEW PROJECTORS AID DENHAM FILM

The new Brenkert "80" projection equipment recently installed in the Denham theater is proving to be highly successful, judging from audience reaction, the management of that theater revealed Monday.

The new projectors, which were initiated last Friday with the opening of the new technicolor picture, "Shepherd of the Hills," have brought lavish praise from patrons who particularly have pointed out that the color of "Shepherd" is the most beautiful and most natural they have ever seen, the management said.

With the intense light thrown by the Brenkert projector, both screen characters and landscapes are seen in their greatest detail, it was explained. The veins in a leaf, the wrinkles on a face, the twinkle in an eye—all of the small details formerly lost to the eye of the film patron—now are clearly perceptible and there is a complete absence of eye strain.

The Denham management also announced that 20,220 persons have seen "Shepherd of the Hills" since its Friday opening.

20,220 Persons Already Have Seen and Raved Over the New Brenkert "80" Technicolor Projection of This Great Attraction!

AIR CONDITIONED COMFORT

DENHAM

HAROLD BELL WRIGHT'S

"THE SHEPHERD OF THE HILLS"

IN GLORIOUS TECHNICOLOR

Starring

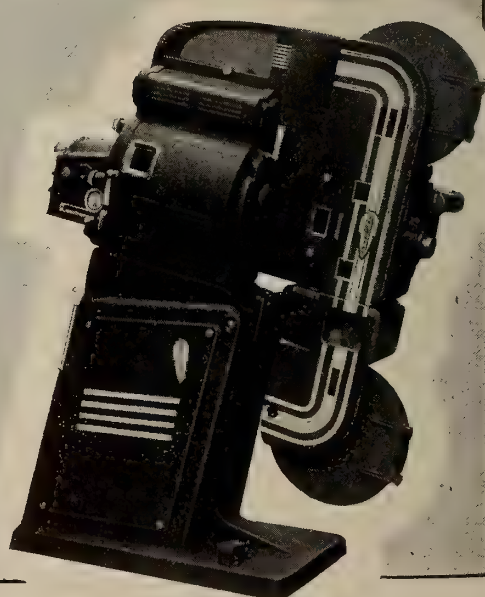
JOHN WAYNE · BETTY FIELD

HARRY CAREY

BRENKERT PROJECTORS ARE AIDING BOXOFFICE RETURNS THROUGHOUT THE NATION!

Brenkert projectors—correctly engineered—carefully built—continuously produce BEST PROJECTION that pays dividends at the box-office.

Brenkert factory-appointed distributors in all major film distributing centers throughout the nation will be glad to show you the "Brenkert 80"—the modern motion picture projector.



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BRENKERT LIGHT PROJECTION CO.

ENGINEERS AND MANUFACTURERS • DETROIT, MICH., U.S.A.

INTERNATIONAL PROJECTIONIST

VOLUME XVI JULY 1941 NUMBER 7

Reproducer Troubles Due to 'Grounds'

By *LEROY CHADBOURNE*

GROUND troubles, formerly among the less important sound equipment problems, have been brought to the fore by present-day conditions outside as well as inside the projection room, and according to some very well-informed sources they have now become the most important single cause of reproducer trouble.

Developments outside the projection room, which are responsible for this situation, include particularly a great increase in the number and power of short-wave radio transmitters. Two-way police radios also figure in this picture, inasmuch as the mobile transmitters, while not actually powerful, may be driven very close to theatres. A great increase in diathermy and similar medical machines, which also emit short-wave radiations, likewise increases the possibilities of trouble.

Inside the projection room, the design of modern sound equipment facilitates response to such disturbances. The modern amplifier has more gain, making it more sensitive to signals originating in the photo-cell, but also more sensitive to unintended impulses originating elsewhere. Modern amplifier design tends to dispense with the transformers and choke coils which, in earlier models, sometimes filtered out extraneous disturbances.

For all of these reasons, modern sound equipment relies more heavily on correct grounding kept in good condition. Ground faults which formerly did not cause serious trouble, cause trouble now, and so extensively that grounding faults have risen to top rank among the causes of poor reproduction.

The manufacturer's grounding instructions, very carefully followed, will prove right for his system nine times out of ten; but the tenth time they may prove wrong in some specific projection room. Most ground troubles manifest themselves as noise, pick-up of extraneous disturbances, *etc.*, but the causes behind these conditions may vary. Generally cured by improving specified ground contacts, they sometimes require changing of the specifications. Hence the nature of elementary ground troubles should be understood.

The fact that the earth is rather a good conductor puzzles some men, who argue that rock, soil and the like are not the most efficient conducting materials. They are not, of course—but the cross-section of the conductor is enormous. It can carry any amount of current, but its local conductivity varies according to the nature of local materials. Moist soil, dry sand, rock, here and there a water-pipe—obviously, if there are currents flowing in the earth there will be sharp local differences in potential.

Alternating currents of every kind are induced in this conductor, *i.e.*, the earth: there is induction from power lines, radio waves of every kind, as well as natural currents which don't trouble the projectionist as a rule.

Now look at Fig. 1A, which a skeleton diagram representing a common method of coupling the photo-electric cell to the first stage of amplification. Coaxial shielding is not shown: it would, of course, surround the wire that runs horizontally across the top of the drawing. Its presence and proper grounding may be assumed.

The return in the case of Fig. 1A is through ground, a rather common practice. Occasionally, however, the projectionist does not know his return is through ground unless he studies his blueprints rather carefully, because that fact may be obscured by switching or changeover arrangements omitted from this skeleton drawing, where the dotted line indicates the return is *via* ground.

Now, assume that for any cause—proximity of a short-wave transmitter, passing of a police car equipped with two-way radio, operation of a diathermy machine, and so on — high-frequency currents are induced in the earth in the vicinity of the two ground connections shown in Fig. 1A. In that case we may accurately regard that section of the earth as being a generator of high-frequency alternating potential, as shown in Fig. 1B. The latter is exactly the same as Fig. 1A, if trouble-making earth currents are operating in the vicinity.

In Fig. 1B the earth is a generator and its load is a portion of the sound system which includes the ½-megohm grid resistor.

Next, remember that this diagram shows an amplifier, the nature of which

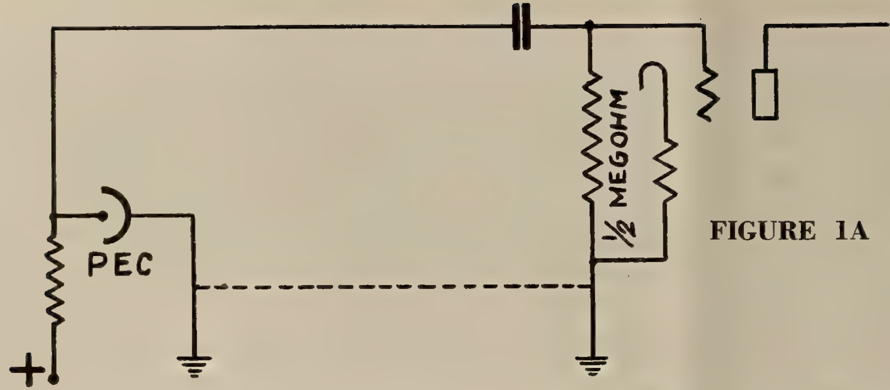


FIGURE 1A

is that any alternating potential appearing across that grid resistor is going to be amplified. If it is a fluctuating potential derived from the photocell, well and good; but if it is derived from some other source and gets across that ½-megohn resistor, its amplification must follow. And Fig. 1B shows how A.C. of foreign origin can sometimes get into that resistor.

If the alien A.C. happens to be pure short-wave high frequency, no harm will result, since the loudspeakers cannot reproduce it, the ear cannot hear it, and subsequent parts of the amplifier, including the output transformer, will suppress it. In that case harm will result only if the pickup is of such great strength as to overload the tubes, causing them to distort the normal sound.

If, however, the alien frequency is in any way irregular, the amplifier tubes will tend to act as detectors, separating and then amplifying those irregularities. The irregularities may consist of audio frequencies which have been superimposed on the high-frequency carrier wave, as in radio voice transmission. Sometimes they may be a series of clicks, by which the high frequency wave has been broken into dots and dashes for radio-telegraph transmission. Diathermy machines, particularly of the spark-gap type, produce h.-f. waves that are inherently irregular, or "damped," and these are enormously disturbing.

The reader may conclude, that all this is easily cured by substituting a good solid connector for the dotted line of Fig. 1A, and any possible disturbance created by the phantom generator of Fig. 1B will be effectively short-circuited.

That is exactly what is intended, and that is just where trouble starts. In a properly grounded system all the grounds are very thoroughly bonded together, either through pipe or conduit or through running a separate ground wire for the purpose. The conduit, or the ground wire, or the coaxial cable shield, effectively convert the dotted line of Fig. 1A ito a substantial conductor—provided that the contacts are properly made. Trouble begins when these contacts are either faultily made or become faulty in time. Then one end or other of the dotted line of Fig. 1A open-circuits, the earth becomes the only return, and the condition shown in Fig. 1B appears.

In these drawings the condenser at lower left of Fig 1B is, of course, the photo-cell of Fig. 1A, the p.e.c. being partially equivalent to a condenser in the sense of forming a conducting medium for high-frequency pickup.

Figures 2A and 2B illustrate another way in which faulty grounding can produce trouble. Every projectionist knows that very high impedance in a grid circuit tends to pick up disturbances as static charges, alternating or direct. Many modern amplifiers can be made to pick up the hum of their own power transformer by disconnecting the grid cap of a high-gain tube, thus introducing some millions of ohms of air resistance between cap and grid. The photoelectric cell line, being of high impedance, is run in coaxial cable to shield it as thoroughly as possible from picking up extraneous disturbances.

In Fig. 2A it is assumed that the right-hand ground contact has loosened and collected dirt, or corroded, so as to develop high resistance, indicated by the dotted resistor in that drawing. There still remains a solid ground connection through the lower horizontal line to the left-hand ground, but in spite of this the condition of Fig. 2 sometimes appears, and disturbances are picked up by virtue of the high impedance of the right-hand ground. Such disturbances are sometimes materially reduced by improving the left-hand ground connection, but not always removed entirely until the right-hand ground has been perfected.

It should be remembered that these drawings represent the case much more simply than it may be in practice. A theatre has a great deal of wiring, all of which is grounded, or should be. In an old house, particularly, there is likely to be a perfect labyrinth of grounds, many of them relating to abandoned and forgotten circuits; to wiring that has been taped up at the far end but never disconnected at the meter; abandoned branch lines, forgotten conduit runs, and so on. Many of these forgotten grounds my be corroded; old conduit may be partially rusted away.

Ground troubles in such theatres can prove very difficult to cure, because there are all kinds of unknown inter-linkages, or unknown and different ground resistances. It is in such houses, especially, that it may be necessary to depart from manufacturer's recommendations and tackle ground troubles by method of trial and error. Removing ground contacts rather than improving them, and either leaving them off or running them by solid wire to some other earth contact, in most such cases results in a cure; but a great deal of trial and error work may be needed to find which contacts to remove, or where else to run them, if they are not left open entirely.

This type of ground trouble is the exception. Nine out of ten difficulties are caused by accidental departure from the manufacturer's grounding specifications.

Sound system grounding specifications differ only in detail. The general outline is to a degree the same for all systems. All call for a central ground; usually a water-pipe. Most makers designate a number of points in their systems that should be bonded to a wire of good-sized cross-section, such as No. 12, this wire in turn going to the water-pipe ground. Additionally, there are other points which are bonded to this wire indirectly, through conduit or cable shielding. The general idea is likely to be a "star" connection from varied points and through varied conductors to the ground

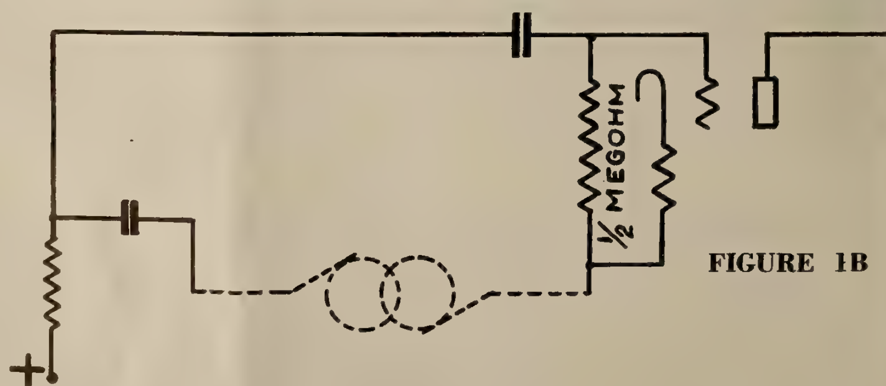


FIGURE 1B

wire, and thence to the earth contact.

The important factor in these arrangements, as already explained, is *low resistance* at every contact and through every conductor constituting the ground "star." High resistance at any point is likely to lead to trouble.

Sometimes the ground is not properly made at the time of installation. Sometimes trouble develops afterward. There are three general causes for high resistance: one is improper mechanical connection to conduit, water pipe or cable shield; another is a faultily soldered connection; the third is high resistance in the water-pipe between the point where contact is made to it, and the point where it enters the earth.

Mechanical faults relate to cable or conduit connectors, or ground clamp connection to the water-pipe. A prime cause is failure to *clean* such surfaces perfectly before the mechanical connection is made. If they are held apart by ever so small a scrap of paint, for example, an airspace will exist in which moisture may condense and cause corrosion. All ground connections that do not involve soldering should be both clean and tight, *and this naturally includes all connections in conduit or cable through which the ground circuit runs.*

Where two dissimilar metals are physically joined, the chances of corrosion are multiplied. For this reason, two dissimilar conductors, separated by a liquid conductor, constitute a battery. To get useful current from such a battery it is necessary to select the conductors carefully, such as zinc and carbon, with a solution of ammonium chloride, in dry cells; or lead and lead oxide, with a solution of sulphuric acid, in storage batteries—but almost any two dissimilar conductors in any conducting liquid are a battery of sorts, and the conductors will slowly corrode by battery action. As they corrode, the contact changes from one of low resistance to one of high resistance. All mechanical bonds should therefore be made between clean surfaces and be physically tight. Very tight.

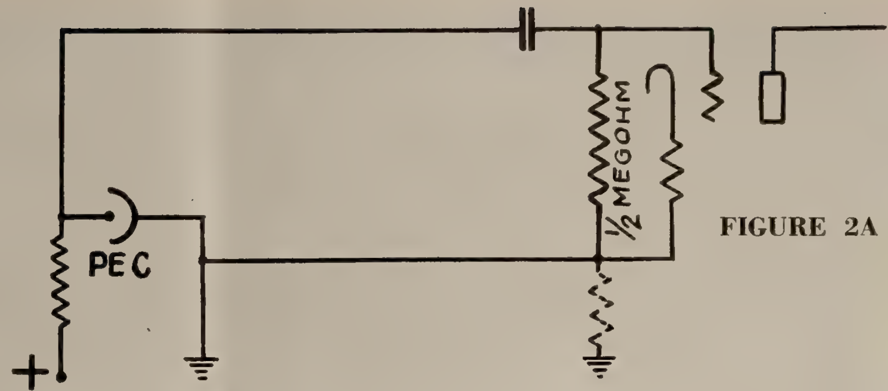


FIGURE 2A

Where the original physical bond was well made, but is subject to vibration, it may loosen in time. Dirt and moisture get in, and trouble may follow. The remedy is not to simply tighten such a connection but to open it, clean the surfaces very thoroughly, and then tighten it.

The second class of troubles relates to improper soldered connections, and these are always due to faulty work at the start. A properly made soldered joint stays good.

There are several reasons for faulty soldering, one being that installation work may be done by power electricians whose work does not normally require the degree of perfection in ground contacts needed by a sound reproducing system. What is ordinarily good work to them may constitute very poor work in a projection room. But when the projectionist himself does the work he may err in another way. His soldering equipment, his experience, may be best adapted to small parts, such as amplifier wiring.

The use of a small soldering iron on a ground clamp affixed to a water-pipe is almost certain to produce a cold joint: the water pipe carries the heat away as fast as it is applied. The clamp should be soldered to the wire first, and fixed to the pipe afterward. Of course, corrosive fluxes should not be used, and in all ways the soldering should be done with the maximum care to produce a permanently perfect connection.

In a few cases the water-pipe itself has been known to develop high resistance in its joints, elbows or T's. Joint caulking compound used by plumbers is sometimes the cause of this. In general, it is considered good practice to carry the ground wire—No. 12 or whatever size is specified—to the cellar and attach the ground clamp to the water pipe just at the point where it enters the cellar, where there are no fittings of any kind between the ground clamp and earth. In theatres where this would be too long a conduit run, the water-pipe itself must be suspected in cases of ground trouble.

The quickest way to deal with ground troubles is always to first inspect the water-pipe contact. Here is where all the grounds center. A tug at the ground clamp is not enough. It should be taken off and the contact surfaces inspected. The soldered connection should be checked, perhaps touched up with a hot iron.

After check-up of the central ground, check the various star branches, with special attention being given to physical bonds. Where a tightening of these effects the trouble in any way, open that connection entirely and inspect the contacting surfaces, cleaning them if necessary. Where such tightening helps but does not cure, the circuit drawing of the piece of apparatus involved (as in the illustrations here given) may afford a useful clue toward where to look next. If not, continue checking all grounds and ground-links and physical contacts until you are sure the manufacturer's specifications are completely fulfilled.

Nine times out of ten this will cure the trouble; the tenth time it may be necessary to detach grounds, either running without them or linking them differently, *i.e.*, changing the outline of the ground star. In perhaps one case in a hundred even this will not serve, but the frequency of the disturbance (or of its short-wave carrier) will have to be ascertained and filters introduced into the ground line through which it reaches the system. Such filters are usually simple, very often only a few turns of wire on a cardboard spool, turns being added or taken away until the maximum filtering effect is obtained. The coils are usually connected in series with the line.

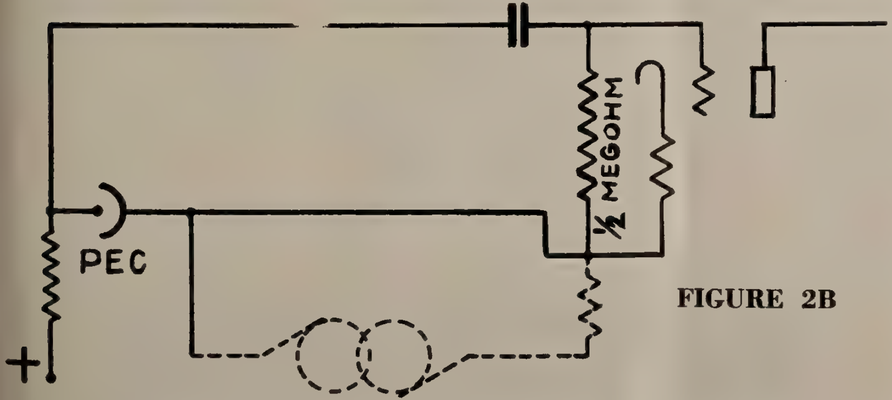
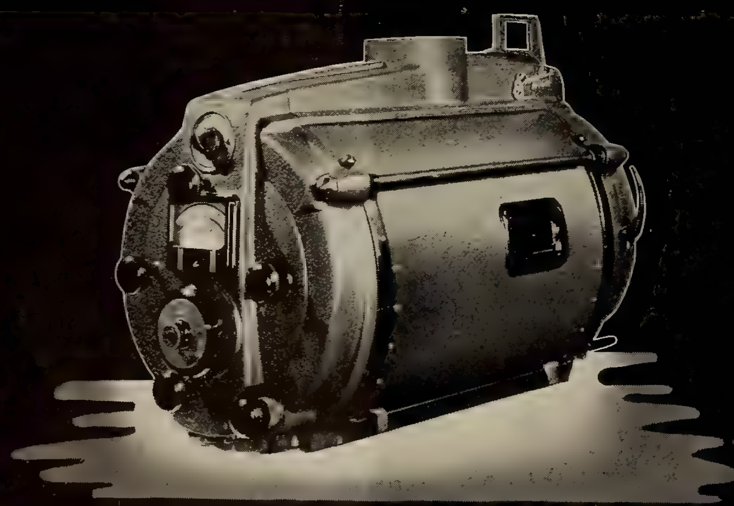


FIGURE 2B

Increase your business by buying light at LESS cost!

	LUMENS (Unit of light measurement) DELIVERED	OPERATING COST PER HOUR	LUMENS DELIVERED PER HOUR FOR 1c	HOURLY COST 1000 LUMENS	COLOR CHARACTER OF LIGHT
SIMPLEX HIGH ONE-KILOWATT ARC LAMP	2000	15¢	133	7½¢	SPARKLING SNOW-WHITE *(Necessary to satisfactory projection of Technicolor)*
YOUR LOW INTENSITY ARC LAMP	1000	13¢	77	13¢	MUDDY YELLOW



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Recent Advances in Non-Reflective Lens-Coating Processes†

As early as 1892 it was known that the reflectivity of polished glass surfaces was reduced and the light transmission increased when a suitable film was present on the surface of the glass. Many efforts to produce such a film artificially met with only partial success. In the past five years, two different methods have been discovered that achieve the desired results. Only one of the processes, however, was satisfactory for commercial application. Great improvements have been made in the durability and weather resistance of the thin films deposited upon the lens surface by this method. Lenses coated by this improved process require no more careful handling than any good lens is entitled to; fingerprints and dust can be removed without detrimental effects to the coating. The thin films can not be scratched with anything less hard than a metal point. By this process reflectivity can be reduced from an average of 5 per cent for untreated polished surfaces to as low as 0.5 per cent for treated ones. Experiments show that even greater reductions are possible and should be available in the near future.

By *WILLIAM C. MILLER*

VARD MECHANICAL LABORATORY, PASADENA, CALIFORNIA

ALTHOUGH it had been known for many years that certain types of glass developed a tarnish after prolonged exposure to the air, it apparently was not until 1892 that any careful study of the effects of such tarnish was made. At that time H. Dennis Taylor, famous lens designer, made careful measurements upon several tarnished lenses that had come to his attention. The tarnish had the appearance of a metallic sheen and had always been considered to be highly detrimental.

The results of Taylor's measurements and tests, however, showed that the tarnished lenses reflected less light from their polished surfaces than did identical new ones. This of itself was of great importance, but of still greater importance was the fact that the light that was no longer reflected by the polished surfaces was transmitted by the lenses. The tarnished lenses produced images measurably brighter than did identical new and untarnished lenses.

Taylor was so impressed with the potentialities of the discovery that he made extensive experiments to find means of producing this tarnish artificially on the surfaces of new lens elements. Unfortunately he met with only partial success, for the types of glass that he was able to treat proved to be limited. Furthermore, the reduction in reflectivity obtainable with many of the glasses was too slight to be of commercial value.

Many efforts were made in subsequent years to discover methods of artificially producing the desired results, but with only moderate success. Kollmorgen, Kellner, Wright, and Ferguson all made contributions to the art, but certain types of glass resisted all attempts to produce a tarnish of the desired nature.

Chemical Processes Unsuitable

All the processes developed up to that time were of the chemical type; that is, they depended upon the action of chemical solutions or concentrated salts upon the surface of the glass to produce the desired tarnish. Since this reaction took place with the glass itself, it was impossible to remove the effects of the treatment without completely refinishing the optical surface, a costly and time-consuming procedure. The greatest care was therefore necessary in the treatment of optical elements to insure satisfactory results, since an error meant refinishing the surface or making a new element. This treatment could not be safely attempted by anyone other than the makes of the original optical parts.

Since many varieties of glass are employed in the lenses in common use, and many of these glasses either could not be treated at all or could be treated with only moderate success, the application of the process was not widespread.

What was required to make the theory universally practical and applicable was a method of producing the tarnish upon lens surfaces irrespective of the type of glass from which the lenses were made and would yield reductions in reflectivity sufficiently great to justify the trouble and expense of application.

In view of the many years that elapsed with little or no successful development of the art, it is remarkable that two independent processes of quite a different nature should be announced within the short period of three years. The first announcement came in 1936 of a process discovered by Dr. John Strong of the California Institute of Technology. Strong's process consisted of the deposition of a thin film of suitable material upon the surface of optical elements in a high vacuum. This thin film, when deposited under the correct conditions and to a specified thickness, effected reductions in the surface reflectivity as great as 85 per cent.

The second announcement came in 1939 of a process discovered by Miss Katherine Blodgett of the General Electric Laboratories. Miss Blodgett's process consisted of the formation of a soapy film of the required characteristics upon the surface of optical elements. Although the reductions in reflectivity achieved by this process were great, the extreme fragility of the film made the process impracticable for general use.

Theoretical Considerations

The quantity of light reflected from the polished surface of a transparent material and, therefore, lost from the transmitted beam, depends upon such factors as the index of refraction of the material and the angle at which the light strikes the surface. If the angle of incidence is kept constant, then the index of refraction is the determining factor, and the higher the index the greater is the percentage of light reflected.

Light can be considered as traveling in a wave form. When a beam of light is reflected from two parallel polished surfaces of a transparent material, the light-waves can be made to supplement or oppose each other in the reflected beams by suitable adjustment of the separation of the reflecting surfaces. When these have an optical separation of ¼ of a wavelength, the waves in the two reflected beams oppose each other and cause destructive interference. The total intensity of the reflected beam will

† J. Soc. Mot. Pict. Eng., Aug., 1941.

be zero when, and only when, the two components are of equal intensity.

If we wish to reduce the reflectivity of the polished surfaces of an optical element and thereby increase their transmission, it can, therefore, be done by providing over the entire element two reflective surfaces separated by ¼ wavelength, both surfaces reflecting an equal amount of light. Under these conditions, the two beams will cancel each other. Although it was not clearly understood until the time of Dr. Strong's work, it was this interference phenomenon that accounted for the effects observed by Taylor and the others.

The most satisfactory method of producing the two reflective surfaces separated by the correct distance is to form upon the surface of an optical element a film of transparent material of such nature and of such refractive index that the light reflected from the contact surface where the film touches the glass equals that reflected from the upper surface. This index can be found with little trouble to be equal to about 1.25.

The effects that Taylor observed first were due to the formation of a film of approximately the required characteristics by the chemical action of the air with some of the constituents of the glass. The chemical methods that were subsequently developed all aimed at the artificial stimulation of such a film. The failure of the methods to produce more satisfactory results was due to the fact that a film of the required index could not be formed on all types of glass. Even the process developed by Strong missed perfection in that particular respect, for there is no suitable substance that can be applied in the form of a film having an index as low as the required 1.25.

All the processes — the chemical by Taylor, Kollmorgen, Kellner, Wright, and Ferguson; the evaporation by Strong; and the one by Miss Blodgett—fail in one other important respect which offers such natural obstacles that it may never be surmounted, that is, the thickness requirement. The film can be made of the required thickness for only one wavelength at a time and is, therefore, wrong for all others. Consequently, when white light is used, the reduction of reflectivity can be made a minimum for only one color; all others suffer greater amounts of reflection.

Fortunately, the difference for other colors is not great, but it is sufficient to give treated surfaces a colored hue when viewed by reflected light. If all colors were reduced equally, the remaining small amount of reflected light would not display any predominent color.

Optical systems designed to work with light of some certain wavelength should be treated to give maximum transmission for that wavelength. Complying with this rule there are in use in the studios many violet recording systems that have been treated for maximum transmission at about 4000 A.

Sound-recording systems consisting of ten air-glass surfaces have been treated both for violet and unfiltered light. A gain in transmission of 50 per cent was measured in nearly all cases. Since the tungsten recorder lamps are of necessity burned at or near their peak capacity, this 50 per cent increase in transmission in the optical train has made it possible to relieve the load on the lamps and thereby considerably increase the lamp life.

In some instances the gains obtained by treatment of the lenses have been utilized, not to save current or lamp life, but to make possible the use of slower, finer-grained films.

A large number of motion picture camera lenses has been treated during the past year. Careful measurements made at one of the major studios on a 3-inch focus Cooke Speed Panchro lens at $f/2.0$ showed the transmission of the untreated lens to be 69.5 per cent. The transmission of the lens when treated was 95.1 per cent. In other words, the light loss had been reduced from nearly 30 per cent to less than 5 per cent. Another studio reports measurements showing a gain of 32 per cent due to treatment of another type of lens.

Of even greater interest than the increase in transmission is the improvement in the image quality due to this treatment. The increase in contrast and brilliance of pictures made with treated lenses is very noticeable. In work where the utmost in image quality is required, such as in process projection keys, the treatment is of great value and is widely used in several studios.

Due to the number of steps involved

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in the production of a finished process shot, it is necessary to apply every known means of reducing the losses of picture quality to a minimum. Since these are primarily losses of brilliance and contrast, the very features that treated lenses enhance, the application of this treatment to both the projection and camera lenses used in process work is of great value. Reports of the results obtained in this field are definitely satisfactory and gratifying.

Process Projection Gains

Another of the major problems encountered in the process work is that of screen illumination. Constant efforts are being made to increase the light output of the projection systems used in this work, and gains of 10 to 20 per cent have occasioned loud rejoicing. Yet actual tests by the studios have shown that by treating the projection lenses, gains as high as 30 per cent are to be had. One studio had a peak screen illumination of 24,000 lumens with untreated projection lenses. After treatment 30,000 lumens were obtained—an increase of 6000 lumens.

In straight production work the results are no less interesting. Treatment of lenses has so reduced ghosts and flares that it is now possible to apply hitherto unusable methods of set illumination. This is particularly true of low-key sets.

There have been several successful pictures made during the past year in which low-key lighting greatly enhanced the atmosphere of the picture. No small part of the success of these scenes was due to the clarity and brilliance with which they were reproduced through the use of treated lenses. Intense local lighting did not mask out shadow detail or cause ghosts of any sort.

Of particular interest was one shot, made in a dark hallway, of two characters approaching cautiously with a flashlight. Quite by accident the flashlight was turned full into the lens of the camera. But contrary to expectation the shot was not ruined, for no flares appeared and the dimly lighted faces of the two characters could still be clearly seen over the brilliant image of the flashlight.

The reduction of flares or ghosts is so great that tests with treated and untreated Astro lenses shooting straight into the sun show a bare trace of one ghost with the treated lens which before treatment gave thirteen conspicuous ghosts.

As the results obtained with the treated lenses became available and comments and criticisms from the users drifted in, the need for more research work on the process became obvious. A harder and more durable treatment was definitely needed. The research program that was undertaken in our laboratories had for its objectives four primary aims:

First, it was desired to produce films that were much harder than anything available at that time. The aim in this respect was to produce films which were just sufficiently softer than the underlying glass to permit the removal of the film without damage to the lens element should the removal be required. Second, this hardness must be obtained by means other than baking, for it was felt that to subject precision optical parts to high temperatures was decidedly detrimental. Third, the films must be sufficiently resistant to vapors to eliminate any tendency to fog in normal use. Fourth, the efficiency of the films must not be impaired while obtaining this increase in hardness.

Harder Coating Achieved

Many months of intensive experimental work were devoted to this program. Several methods of improving the process were discovered, but the final method was so superior to any of the others that it was made the subject of patent application.

Where previously the removal of dust from a treated lens with a soft camel-hair brush had often resulted in damage to the coats, the new hard ones could be handled with no more care than any good optical element deserves. Test samples were subjected to very severe treatment. Finger marks were repeatedly placed on them and successfully wiped off. They were allowed to lie around the laboratory for long periods where they accumulated dust and dirt, which was then removed without damage to the treated surfaces.

Those acquainted with the fragility of the early coats would be astonished to witness demonstrations of the hardness of the coats when they are jabbed and scraped with wooden sticks, breathed upon, and wiped with cloths without damage. One of the most popular tests is to rub a sample through the hair to coat it with oil and then to return it to its original efficiency and unblemished state by rubbing it with a cleaning pad.

This welcome durability was obtained without loss of efficiency of the films, as was the intention. Coated surfaces reduce the reflectivity of polished glass to $\frac{1}{8}$ or less of the original value. Sample glass disks coated on both sides, but only in the center, give a most interesting demonstration of the efficiency of the films. When held between the observer and the sky, the treated central portion is decidedly brighter than the surrounding untreated area, due to the increased transmission.

These same samples, held between the eye and some dark background such as black pavement, show a brilliant ring around the untreated edge where the bright sky is reflected in undiminished intensity. The treated center, however, appears quite dark and the pavement beyond can be seen without difficulty, whereas it is seen only indistinctly elsewhere through the glare of the reflected skylight.

A camera lens was treated for demonstration purposes so that only one-half of each element was coated, and the treated halves were lined up so that they were all on the same side when mounted in the barrel of the lens. Either by reflected or transmitted light the effect is most impressive. By reflected light, the iris diaphragm is barely visible through the glare of the light reflected from the untreated halves of the first four surfaces; while through the treated half it is clearly visible, as well as interior details of the lens mounting as far back as the last element.

When viewed against the sky, the treated side of the lens is markedly brighter than the untreated half. When

(*Continued on page* 26)

Theatre Roofs, Equipment For Anti-Aircraft Defense?

RANKING near the top of the list for originality is the idea contributed to National Defense by Henry D. Behr, former supervisor of projection for Wilmer & Vincent Theatres and now busily engaged in defense production work. Behr describes his idea as follows:

"Most of our 16,000 movie theatres are equipped with power conversion apparatus suitable for the operation of high-power carbon arc searchlights. By means of extension cables sufficient current could be brought to these searchlights which could be mounted on the roofs of theatre buildings or on adjoining structures.

"The personnel to operate this equipment is immediately available (meaning Mr. Projectionist or Mr. Stagehand, of course) and the only major expense involved would be for the cable and the searchlight equipment itself. Of course, the plan would augment the mobile lighting units now in use or in production. Coastal areas and other vulnerable areas in this country are dotted with theatres that would provide an excellent basis for trying out this plan or any modification thereof."

It is understood that this idea was submitted to the War Department quite a few months ago, but apart from a formal acknowledgment of its receipt the Army has done nothing to determine the worth, or lack of it, of the idea. Technically, the plan would seem to be entirely feasible.

Feminine Film Hands Busy In British Projection Rooms

By *MARJORY BOULTON*

The appended story of British women's war efforts is a portent of things to come not only in Britain but possibly in Canada and other localities where demands for defense manpower take precedence over every other requirement. While women projectionists are no novelty, [several women in the United States still hold state or local licenses] very few if any of the fair sex are active in the craft. The reader will note that the steadfast British stanchly decline to adopt American nomenclature for projection equipment and technique.

THOUSANDS who visit the British cinemas these days are unaware of the drastic change that has taken place in the projection rooms during the past few months. As often as not, the skilled hands which keep the film running through the projectors nowadays belong to a woman. Two thousand women are now being trained or are already working as projectionists.

This is a story about one of them, Miss Edith Macknay. I stood beside her as, wearing neat, business-like overalls, she deftly manipulated the controls of the projection apparatus. While we talked her eyes and hands were never still. She would peer through the small, square window of the projection room to see if the film was in focus on the screen. Then, with her right hand she would open the upper spool box to check the running out of the film, the while she adjusted the negative and the positive carbon feeds with her left. [ED.'S NOTE: Verily, a dexterous lady. Try this sometime.]

She was as preoccupied as the driver of an automobile. Near her stood the operator of the relief projector, awaiting the signal on the screen that would warn him to warm up the other machine for the changeover.

When the large spool of film still unwinding in the top spool box of Miss Macknay's machine ran to its end, the relief operator would take over without a break in the continuity of the film. In the darkness of the projection room [Interior blackout, ay?—ED.] the air was full of the hot, vibrant smell of high-voltage electricity and the sound of the metallic grinding of the projectors. ["Repair and replace . . ."—ED.] The voices reproduced from the sound track echoed harshly in the room monitor.

Catering on a Larger Scale

"Up to last March I was in the catering business," said Miss Macknay. "When the call came for women munition workers I resigned my job and went to our local registration bureau. Here I was told that I was not suitable for this type of work.

"Well, there I was. Thirty-nine years old and out of a job. Can you wonder that I felt a little desperate? A bit further down the same street I saw an advertisement which stated that women trainees were required for work in the projection rooms of cinemas. I applied, and I was taken on in this cinema almost at once. In a way, I suppose this is war work. If enough women become efficient projectionists, it will prevent the closing down of many London cinemas when the men are called up for service."

Although Miss Macknay has been three months in the projection room she still is in the trainee stage. "It takes about ten months to learn the job," she told me, "but I earn enough while learning to enable me to support my mother—my only brother being in the army. When I first came into the projection room the noise worried me considerably. After a while I became accustomed to it, and now when I am at home I actually miss it! I've always wanted to work with machinery, so one of my ambitions has been realized.

"Of course, most girls are at one great disadvantage when they take on this sort of work. That is their almost complete ignorance of the fundamental principles of electricity. Nearly every boy, when he leaves school, has some idea of what it is all about, but most women have to learn from the beginning."

Miss Macknay works from 10:30 a.m. to 10 p.m., with time off for meals and rest. She has every Sunday off and in addition one early evening a week.

"In the mornings," she stated, "I help to clean the projection room and to rewind the used spools. Then we clean the rewind tables, also the arc lamps, then we mend any tears or breaks in the film. When the show starts I make myself generally useful. One of my jobs is to help attend the projectors—they need as much careful vigilance as do children. Then I take the used spools into the rewinding room and rewind them. After that they are put back into the library.

"I am looking forward to the day when I take full charge of my own projector."

'Women O.K. on Job'—Chief

The chief projectionist was confident that women could make efficient projectionists. "Besides learning the technical side of their work, they must be trained to keep cool heads in an emergency," he said. "So many little things can go wrong during the running of a film inside the projector, not to mention the sound apparatus, and nearly always the first serious thing that happens is an outbreak of fire.

"The combination of very high voltage electricity and easily inflammable celluloid film is a dangerous one. That is

Itinerant Show Boom Bad News for Theatres

A NEW high in itinerant exhibition in the Mid-West is claimed this past Summer season by leading distributors of 16 mm. equipment and film. Opinion is bulwarked by announcements in rural newspapers of new 16 mm. stands, both outdoors and in halls, according to *Film Daily*.

Observers report that the comfort of the patrons of these shows is now being taken into consideration, and in many localities special areas are being set aside for the showing of pictures, permanent screens erected as well as a platform for the projection machine, and benches arranged in regular theatre fashion are available to patrons.

Cooperation by Merchants

One of the inducements is the better 16 mm. film now available. An offer made by one of the largest 16 mm. distribs. of a sound projector and a one week's change of program on a rental basis of $22.50 a week. Distrib. also offers liability insurance, sound trailers for rent at 30 cents a week, circus heralds at $1 a thousand, as well as standard theatre advertising material at low rental figures.

Merchants in small towns are being solicited to split the cost of the projector between them. The school or civic organization to which the projector is presented for operation, agrees to run an advertisement trailer listing the names of the local merchants donating the equipment, not less than once a month for a period of two years.

It appears in Indiana that any restrictive action is next to impossible. The greater part of the blame for the development of this competition to the established theatre operator, is charged to poor co-operation extended the ATOI's legislative committee by individual exhibitors who have not felt the sting of such competition.

However, with recent developments involving an accident alleged to be due to negligence of public officials at Lyons, Ind., where an automobile was driven into a crowd of free show spectators, injuring twenty-six persons, the ATOI has a new approach to the 16 mm. problem.

why we have to keep our eyes on our machines every moment they are in operation. If projectionists lost their heads and forgot to switch off the current, the entire projection room would be ablaze in a few moments."

At that moment the signal for the changeover, a small black dot in the right-hand corner of the picture on the screen, became visible. The machine next to Miss Macknay's began to hum.

While the last few feet on her projector's spool were running out, she continued her close watch on the many and diverse elements that go to make up a modern visual and sound reproducing system. Then, as the window in front of her projector became dark and the other machine "took up the story" without a break, she lifted the film out of the lower film box and started for the rewinding room.

Her parting words were: "Tell any girl who is interested in machinery to apply for this job. It's fascinating."

HALF OF MOVIE FANS ARE LOST AT AGE 40, DR. LIST HOLDS

Fifty per cent of the nation's theatregoers cease to be regular patrons when they reach the age of 40, according to Dr. J. S. List, consulting psychologist, who contends that 75 per cent of the patrons are lost to the theatre when they reach 60 and 98 per cent at the age of 70. Dr. List bases the figures on a thorough study of polls and surveys and he lays the blame for the diminishing market to a lack of understanding of adult tastes on the part of the producers and the failure of exhibitors to cultivate their publics.

The majority of theatres, both independent and affiliated, have failed to capitalize on their ability to get people interested in making their neighborhood shows a community meeting place, he asserts. Most theatre managers, continued Dr. List, are not paid high enough salaries nor are they sufficiently trained to do anything more than look after the welfare of their theatres. Greater contact with their publics would keep more than 50 per cent of adults interested in the movies long after they pass the age of 40, he insisted.

Possible Corrective Steps

His theory that half the theatre fans lose interest in pictures after 40 could be corrected, Dr. List said, if greater attention were paid to tastes of all ages. This, he admitted, would be a difficult task and yet he insisted that psycho-analysis of a story in advance would insure its acceptance by the public as a whole.

In this respect, Dr. List said that the radio industry was a step ahead of motion pictures, declaring that sponsors, advertising agencies and stations carefully diagnose their programs before putting them on the air so that as much mass appeal as possible can be obtained.

MACK WENZEL DIES IN CHICAGO

Mack Wenzel, founder of the Wenzel Co., makers of the line of projection equipment of the same name, died in Chicago at the age of 52. Two sisters and a brother Fred survive, the latter still being very active in the business.

Typical Opinions on Proposed S.R.P. Changes

TYPICAL of the many and varied comments received by I. P. in response to its publication of the Local 150 (Los Angeles) proposals for changes in the Standard Release Print are the appended communications from two contributors whose names are not unknown to readers of these pages. The first, from Frank Dudiak, projectionist at the National Archives in Washington, D. C., follows:

"When the S. R. P. was introduced it constituted a progressive step toward the standardization of projection practice, not only in the theatres but also in the commercial field. Almost from its very beginning, however, one aspect of the S. R. P. was overlooked or, possibly, disregarded. I am referring to the negligence of film exchanges in *maintaining* S. R. P. specifications.

"The film exchange is the connecting link between the theatre and the film laboratory. I don't think that laboratory errors figure importantly in what is patently a breakdown of S. R. P. standards. It seems to me that the fault lies in the unwillingness of the exchanges to set up *and enforce* rigidly penalties against those theatres that wilfully or otherwise alter release print standards.

"Under present practice a print contains a number of different starting marks by the time it reaches the subsequent-run theatres —and these are the fellows who need help the most. Cases are on record where a print carried five entirely different starting and cut-over cues. In another instance there were 22 separate marks within 15 consecutive frames used as changeover cues, and a like number as cut-over cues. What did the projectionist do about it? Why, he put his own marks on so as to be able to differentiate them from the others.

"Who is at fault in such a situation—the projectionist or the film exchange? The answer is obvious. Probably in the near future the S.M.P.E. will undertake to really do something about this print-marking evil.

Too Little Margin of Safety

"Projectionists allow themselves about one foot of film on the incoming reel during changeovers as a margin of safety. I have handled a number of reels with very short fade-ins; consequently, if the changeover were made too soon, a flash of the wide S. R. P. frame line would show at either the bottom or the top of the screen; if it were made one second later, the fade-in would be missed. Investigation disclosed that the length of the fade-in was only about 20 frames — which is entirely too short.

"For this reason I propose that fade-ins at the beginning of reels be at least 3 feet in length; in other words, that the distance from the end of the S. R. P. to the beginning of the fade-in be at least 20 inches, depending upon the type of fade-in."

Another angle of the situation is discussed by Philip A. Towle, of the Garden Theatre, Marshall, Michigan, in the following note:

Would Back Local 150 *Proposals*

"When S. R. P. changeover dots are printed into the film, I always use them. When these dots are omitted (such as on some shorts and on previews) I use either crayon or the Clint Phare marker, or I go by certain scenes in the picture. However, I never use the Phare marker except where the dots will be of use to other projectionists who may be looking for the dots, as I feel that any additional markings constitute film mutilation and as such are to be avoided.

"Fader instructions could be eliminated without occasioning any trouble. I use them only when considerable gain is indicated, and even then I come in on the first showing with only a slightly higher fader setting.

"In general, I would back all the proposals of Local 150 anent changes in the S. R. P."

Take it away, Local 150; it's all yours.

Tips on the Cleaning of Compound Lenses

DO not use ordinary glass-cleaning, or spectacle-cleaning, liquids on projection or sound lenses of compound type. These fluids are perfectly safe for use on lamp mirrors, single condensors, simple lenses or prisms, but they are not safe for compound lenses cemented by Canada balsam.

Nearly all such fluids contain alcohol, ether, turpentine or ammonia, substances that dissolve grease. Canada balsam, used for cementing compound lenses, contains 60% of a resin soluble in alcohol, 16% of a resin soluble in ether, and 24% essential oil. It is in itself a kind of turpentine, or tree sap, and is partly soluble in turpentine; also, its oleo-resins may be more or less disintegrated by ammonia water.

Except in the case of a special lens-cleaning fluid specifically warranted to be safe for compound lenses, use dry lens tissue only. By dampening the tissue slightly it may seem possible to dampen the surface of the lens, and thus promote cleaning, without getting any of the fluid into the cement. But some moisure may get in by capillary action, and repeated cleanings may thereby loosen the cement.

Dirt and grease do not stick to polished glass. Cleaning with absorbent lens tissue, repeated as necessary, will do the job without risk.

MOVIE ATTENDANCE UP 10-18%

Weekly attendance in the nation's picture houses is running 10 per cent to 18 per cent above what it was a year ago, according to The Wall Street Journal which asserts that the public is spending more money on amusements and recreation than ever before.

The financial paper reported yesterday that the rise began on July 4 and, instead of being just a one-day windfall, became a permanent condition. Circuits, the Journal contended, doubled their hot-weather business over that of last year.

Increase is not limited to picture houses, the Journal declared, as the public is pouring out money for legitimate theatre entertainment, horse racing, liquor, books and travel. The paper asserted that "good times are continuing."

Projector Factory Overhaul Procedure

WHAT happens to a projector mechanism when it is sent back for factory overhaul? What is done to it in the factory that can't be done in the projection room, or at least by the manufacturer's field representative? Similarly, if the projector is entrusted to the field representative for less drastic repairs, what does he do that can't be done in the projection room?

Some managers seem to think that their projectionists should be able to make all propector repairs, right in the theatre. Of course, that is true of a number of projector replacements and adjustments. The projectionist is, and should be, able to replace sprockets, gate, tension pads, rollers, *etc.* He can replace gears that need replacing because of some undue pressure or bind-up, provided, however, that the shafts have not sprung. Where shafts and gears need replacement because of long wear, on the other hand, the projectionist should not attempt the job, because it is very likely the replacement parts won't line up perfectly without special tools, gauges—and experience.

At this point certain managers are apt to say that his projectionists are "experienced" men. Now, an "experienced" projectionist is one who, out of every thousand hours of work, has spent perhaps 995 in operations and 5 hours in making repairs or adjustments. An experienced projector repair man, on the other hand, has spent a thousand working hours out of every thousand *repairing* projectors. Naturally, he has acquired judgment and skill, as well as a memory of thousands of small incidents that he can utilize to guide him in any new problem he encounters.

Field Agent's Function

The manufacturer's field representative cannot do everything in the way of projector overhaul that can be done in the factory, but his experience and special tools enable him to do more than the projectionist. He not only has micrometers and special gauges, but grinding equipment and lathes. A sprung shaft, for example, or one suspected of being sprung, can be mounted between centers in a lathe and its trueness then checked with an indicator. Also, when the gears in the intermittent movement need replacing, a field representative may have a special "running-in box" in which those gears can be run-in with grinding compound. Where this is done, grinding compound can't possibly get into the movement case, whereas it will if the new gear is run-in in the projector itself.

In short, a field representative has the equipment and experience and training to do a better repair job than the projectionist; but there are also things a field man can't do. After a given mechanism has been entrusted to him once, or twice at most, it should be given a factory overhaul.

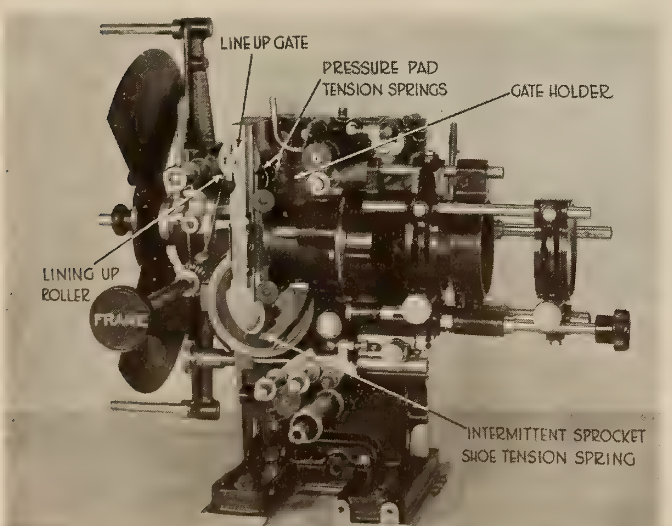
Many managers make the mistake of entrusting their mechanisms to projectionist repair exclusively, thinking thus to economize. This is false economy, and frequently it only makes the inevitable factory repair more costly. The choice may turn out, for example, to lie between a one-hundred-dollar repair job every two years and a two-hundred-dollar job every four years, in which delay saves no money at all and only occasions a less perfect show in the interim.

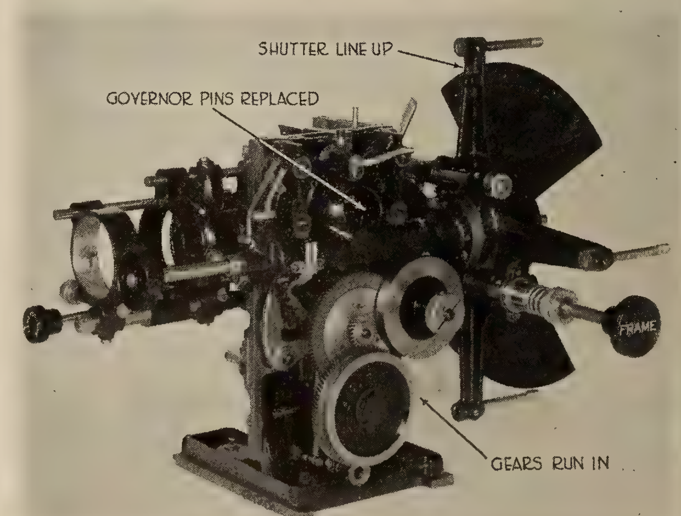
At present there are special reasons for having thorough repairs made promptly. Materials are becoming scarce and factory facilities crowded by defense demands. One manufacturer reports that he is already running low on formica and bronze; another expresses doubt about his supply of alloy steel. At the moment, materials and parts made of the best materials still are in stock. This situation may not endure, and prompt and perfect service may become impossible.

When a mechanism is returned to the factory for complete overhaul, it is first entirely dismantled, stripped to the bone, which means to its main frame. The parts removed are washed and thoroughly cleaned, then checked one by one. The checkup is done with micrometers and plug gauges. The factory has a set of tolerances: there is no guesswork as to whether a given part is to be kept in use or replaced. The micrometers and other measuring devices supply the answer to that question.

The main frame bushings are examined. They generally show wear to an egg-shaped hole, because the pressure on them is not the same in all direc-

All photographs used to illustrate this article by courtesy of International Projector Corp.





tions. Sometimes, especially in repairs made by a field representative, the egg-shaped bushing can be used again by reaming it out and inserting an oversize shaft, which is made for just that purpose. In factory overhaul, however, the procedure is to install new bushings and fit them with new shafts of standard size, which are lapped into place (ground-in gently with oil) exactly as when the projector was first built. It is then a completely new mechanism in that respect.

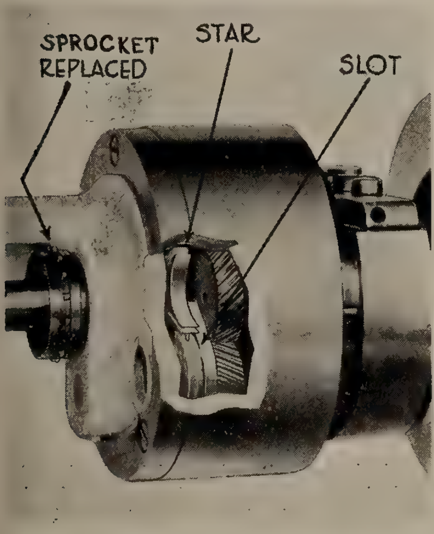
Gears are next examined. The question of which gears need to be replaced is one of judgment based on experience. Some of the new gears are run-in with grinding compound.

The intermittent moment is treated in much the same way as the mechanism itself, except that all standards and criteria relating to the movement are more exacting. It is wholly disassembled. All its bushings and shafts are changed, regardless. New gears are provided, if needed. The radius of the cam is checked with a micrometer and special gauges. The star-wheel is similarly checked; so is the cam pin. These parts are replaced if their measurements at any point fail to meet the factory's schedule of tolerances.

New gears, when installed, are run-in with grinding compound. Star-wheel slots are lapped to practically zero tolerance. The intermittent sprocket is replaced, unless in very good condition. The result, after running-in is completed, is practically a new movement.

The film trap is then checked with straight-edges for warp, and replaced or straightened as may be necessary; its runners, sprocket shoes and pads are generally replaced, regardless. The gate is then lined up with the intermittent—again, a special gauge is used for this purpose. The shutter is now installed and timed.

Next comes the running-in of the



mechanism. This is done with the help of a wattmeter. As the parts run-in and action becomes smoother, the wattage required by the motor declines. The factory has its standards: the mechanism is passed as smooth-running when the wattage required to drive it reaches a certain minimum. If it does not reach that minimum within an established period of time, it is up to an experienced inspector to re-examine the mechanism and find out why not. Any changes, adjustments or replacements needed to correct the condition are then made.

Inspection and Testing

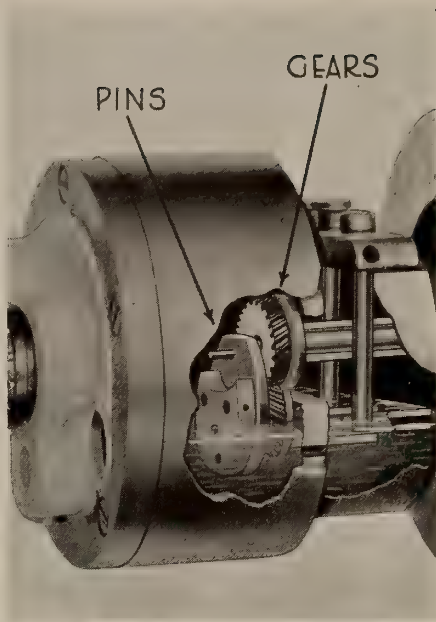
After running-in 's completed, the lens is mounted and squared with the aperture plate. The rebuilding, which started with all parts removed and the bare main frame re-bushed, is then complete. The projector then goes to the inspection bench. Here it is examined by an experienced inspector, who utilizes still other gauges, plus his judgment and experience. He runs the mechanism and checks it for noise; examines every part of it with hand and eye, and then threads up a special test film which is worth a word in itself.

The test film is used to project certain geometrical patterns on a marked motion picture screen, for the purpose of checking picture jump and sidesway. However, film shrinks, thus ordinary prints are passed by in favor of a perforated film. Raw film stock is perforated by a special machine in the projector factory, which punches out the sprocket holes as well as test patterns. A new film is perforated every morning, used for that day's tests, and then discarded. In other words, the factory's standard for steady projection in a rebuilt mechanism is so high that it cannot be checked with ordinary, shrinkable prints.

After the projector has satisfactorily passed the test for steadiness and absence of sidesway, the approved mechanism is gone over once more with a view to tightening all screws and parts. It is then packed for shipment. In the process of rebuilding, worn paint or enamel is replaced, and nickel or chrome plating restored, so that in effect the projector leaves the factory a new machine.

Special Facilities

Mention has been made of special gauges, the term being employed herein as a short cut. Many of these gauges are not commercial devices but special measuring tools made in the factory's own tool shop for one given model of projector, and are unobtainable elsewhere. Some of them are jigs. Re-boring and re-bushing of the main frame, for instance, is done by mounting the



frame in a jig accurately built for that single purpose; without this jig the frame cannot be re-bushed correctly. Reamers may have been made by the factory's own tool-makers and be of designs unobtainable commercially.

All projector manufacturers do not, of course, follow exactly the same pattern of operations in their overhaul work. The foregoing description represents a compendium of common practices. With some changes here and there in details, thoroughness, or general facilities it will apply to the general procedure followed throughout the industry.

BUILDING PROJECTS KEEP PACE WITH FIRST HALF OF '40

Initiative of the exhibition field in the building of new theatres and remodeling existing ones—the current economic situation notwithstanding—is indicated impressively in the results of a survey announced yesterday by John and Drew Eberson, film theatre architects.

Returns show that new building and alterations undertaken by circuits and indie theatre interests East of the Rockies during the first seven months of 1941 amounted to $12,299,000 and involved a total of 413 projects, exclusive of theatres erected by the Government at military posts. Latter's expenditure ran well into the hundreds of thousands.

Equipment Sales Holding Up

Figures furnish a barometer, too, of the large sales effected by manufacturers and dealers in film equipment from the first of the current year to July 15. Such sales have kept up well, it has been noted, with the 413 projects augmenting orders calling for theatre supplies ordered where no new building or alteration was involved.

The seven-months statistics for this year, the Ebersons point out, are not very much at variance with the corresponding span of 1940. In that year's first seven months there were 467 projects recorded East of the Rockies, entailing an expenditure of $12,845,000, approximately.

RCA Takes Over Brenkert Distribution

THE entire output of the Brenkert Light Projection Co., including lamps, projectors and replacement parts therefor, will be taken by RCA Manufacturing Co. effective August 15, according to a joint RCA-Brenkert announcement. This deal, one of the most important distribution realignments ever effected in the projection equipment field, came as a complete surprise to projectionists and to independent theatre supply dealers, many of whom have distributed Brenkert products for more than twenty years.

Under this new arrangement, effected on the 30th anniversary of the Brenkert organization, the dealers will have to look to RCA for all Brenkert products, with the former handling all sales promotion, billing and collections. It is understood that RCA has worked out a financing arrangement whereby the dealers will be able to offer exhibitors a time-payment plan.

The Brenkert side of the story was set forth in a letter which was sent to all Brenkert dealers and excerpts from which follow:

" . . . We have a sufficient and effesctive personnel to develop and manufacture the finest (equipment) in the industry, but the combined effort of manufacturing, selling and servicing, through distributors, requires a larger personnel than we possess today.

" . . . Only a few of our distributors are in a position to do as effective a sales job as their major competitor in their respective territory. It is a proven fact that a manufacturer cannot develop faster than the sales outlet for his product.

" . . . We believe they (RCA) will distribute Brenkert products through distributors in much the same manner as we have for many years."

Continuing, the Brenkert letter states that this new plan will "give the distributor the benefit of being able to offer a complete line of high-quality products in projection and sound obtainable from one source". It closes with the definite assurance that "the Brenkert Light Projection Co. is wholly owned by Brenkert brothers, and further, that our company has taken this step for no reasons other than as above explained".

Dealer Attitude Uncertain

Dealer reaction to the deal took the form of a hurriedly called meeting of the Independent Theatre Equipment Dealers in Chicago, at which all aspects of the situation were discussed, and which was attended by Homer Snook, of RCA, and Karl Brenkert. Since all sessions were closed to everybody but members it is not known what action, if any, was taken by the dealers. Rumblings of dealer dissatisfaction anent the tieup were evident, however, and it is not improbable that some switches in dealer policy will result.

From the RCA standpoint the deal is an attractive one. First, and probably most important, it adds to the field sales force for Brenkert products the entire RCA sales and service staff, believed to number more than 200 men, the efforts of whom unquestionably will have a pronounced effect upon equipment sales. Second, RCA is now able to offer to exhibitors under one contract complete visual and sound projection equipment, including screens, and thus make financing that much easier. Brenkert, on the other hand, will be able to concentrate exclusively on the manufacturing end, to the complete exclusion of promotion, financing, and bookkeeping.

Considerable speculation exists in the equipment field as to whether National Theatre Supply Co., now confronted with intensified competition in the form of a vastly augmented opposition sales force, will move to strengthen its own outposts by means of a tieup along similar lines.

S.M.P.E. Fall Convention in New York, Oct. 20-23

The Fiftieth Semi-Annual Convention of the Society of Motion Picture Engineers, marking the organization's silver anniversary, will be held in New York City on October 20-23, inclusive, at the Hotel Pennsylvania. Bill Kunzmann, perennial convention chairman, has already announced the personnel of the various committees which will do the work incident to the meeting, and the Papers Committee promises a splendid list of papers in keeping with the anniversary character of the convention.

With the manifold entertainment opportunities provided by New York, it is expected that the Convention will establish a new attendance record.

MOBILE THEATRE UNITS FOR U. S. ARMY WAR GAMES

Three mobile outdoor motion picture theatres are being employed in the area of the U. S. Army's field maneuvers by the United Service Organizations to entertain soldiers during their periods of relaxation from training under simulated war conditions. Contained in specially-constructed streamlined buses, each theatre unit will present full-length shows, including a feature picture, news reels and a comedy.

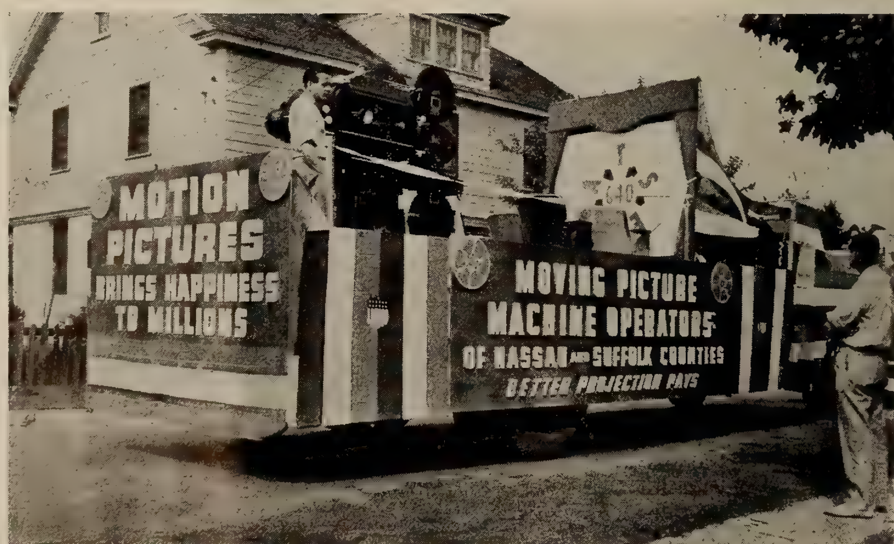
Manned by professional motion picture projectionists and sound technicians, the mobile units carry complete power plants with which to operate their sound motion picture projectors. Each also has a high-powered broadcasting system over which large groups may listen to radio programs or recorded music. The center of each bus is so constructed that it may be elevated to present a picture screen easily viewed by an outdoor audience of several thousand soldiers. The projectors can also be removed for indoor showings.

HUGE GAIN IN 16 MM. OUTLETS REPORTED FOR U. S.

A total of 27,927 schools, CCC camps, and other institutions are now showing 16 mm. pictures on two or more programs a month, according to Jack Friedman of Monarch Film Service. He added that the demand for all kinds of 16 mm. subjects is taxing the producers to supply the required number of films.

The Chicago school system alone is supplying prints to 700 projectors, according to J. E. Dickman, who has succeeded Gerald Bench as director of film activities. All Chicago high schools are equipped with sound projection equipment, as are 150 of the 338 elementary schools. Balance of the lower-grade schools have silent projectors and sound equipment is being ordered for all of them, he said.

Number of sound prints in the school library has reached 2,000 titles with more being added each month. Dickman voiced a preference for more color in films and said that black-and-white slides in the school system are being replaced with natural color material. He said the schools are showing more vocational films than ever before, and are looking for more vocationals, in an effort to aid the National Defense program.



Contribution of I. A. Local 640 (Nassau & Suffolk Counties. Long Island. N. Y.) to parade which preceded dedication of Samuel Gompers memorial on the Island. Note float's boost for industry generally, not only for the Union.

IP AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

AN EXHIBITOR asked if anything could be done to eliminate radio interference caused by his marquee flasher, with radio reception in the radio store of one of his tenants, immediately adjacent to the theatre. Gambling on prior experience, I rather hesitantly said, "Yes".

Therefore, I proceeded to accumulate dozens of 21 CB condensers and placing a show bet also, took along some long discarded choke coils (RF-150 turns, each, of No. 12 enameled cotton covered, close wound, 3½" average diameter, 1½" wide, ⅝" deep).

Results: Condensers were useless, no matter what combination. One choke in each feeder circuit to flashers (2 flashers of 4 circuits each, involved) completely eliminated the machine-gun serenade. Adding condensers to the chokes in typical filter fashion (all combinations) made no difference; in some combinations, worse.

The two flashers involved carried 15 amperes each. In designing your coils remember heat dissipation, or they'll burn up.—G. T. TRAINER, *ALTEC, Aldan, Pa.*

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Voluntarily hooked up the 521 sub. set in one of my houses so they can call the "doctor in the house" from the projection room on a moment's notice. They've had no end of fun with it: for instance, on a Saturday matinee the kids may get a little too noisy so the projectionist flips the switch and calls one or two by name, with a slight reprimand. Result: quiet and consternation.—G. T. TRAINER, *ALTEC, Aldan, Pa.*

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Recent articles in I. P. about the excessive use of oil reminds me of an experience of several years ago. My W. E. sound equipment developed a perfect Roscoe Ates (stutter), which came very frequently but only for a few seconds each time. It never occurred when the serviceman was present, and being of such short duration it could not be located by a process of elimination The main amplifier, a 46-B, was examined; 205-D and also the 264 tubes were replaced, and the head amplifier was gone over—all to no avail.

One night Mr. Ates reappeared for about 45 seconds. Without having any definite reason for my action, I went to the small motor generator set (which furnished D.C. for the exciter lamps, etc.), and put my fingers on the commutator. I noticed that the outer end was decidedly rough and had grooves cut in it. Just about as I did this the stutter ceased.

Next morning I had the commutator turned. The serviceman arrived while I was reassembling it. We pow-wowed and outer brushes until, with the dust and decided that excess oil had saturated the dirt, the oil had formed a good cutting compound and, while cutting, had also glazed until they were not functioning. Then, when a particle of dirt got under one of the inner brushes, raising it momentarily, the current was interrupted just enough to cause a "stutter".

We cleaned the oil-saturated end brushes with alcohol until we could replace them, lowered the oil level in the well. Mr. Ates never reappeared.—C.R.G.

• • •

Poor exciter lamp socket contacts can be a cause of unnecessary sound disturbances, such as low volume from one machine, thereby creating an unbalanced condition between P. E. cells; or said poor contacts can cause a "frying" or hum condition (A.C. lamps) in the output of the amplifier. These troubles can be eliminated or corrected by cleaning the spring contact about once a week with crocus cloth or fine sandpaper.

On most all exciter lamp holders it will be found that this contact can be pushed up through the base of the socket so that same can be easily cleaned. If a condition of melted contacts has been experienced, the aforementioned can be traced to the cause of the trouble.—M. E. PICKRELL, *RCA, Syracuse, N. Y.*

• • •

While making a transmission test recently, I was baffled by a difference in level between the machines of 12 db. I measured the voltage across each exciting lamp, and this was found to be the same in both cases. The current was also exactly the same.

After making several tests without result, I noticed that the brilliancy of the exciting lamps did not seem to be the same. This was the cause of the trouble. In one machine there was a 2.15 amp., 9 v. lamp, while in the other machine there was a 2 amp., 8 v. lamp. This difference in lamps accounted for the difference in gain of 6 db.

I thought I would pass this along in the hope that it will prevent some of the other boys from spending too much money for aspirin!—F. A. LATHROP, *ALTEC, Detroit.*

• • •

On jobs where the lower magazine door falls shut by gravity, it has been the practice in the past to fasten various types of clips and home-made catches to the front wall, in order to hold the door open while "threading up".

To eliminate these unsightly contraptions, a spring may be attached to the lower magazine door hinge tending to hold the door open unless latched.—J. A. DAY, *ALTEC, Detroit.*

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A small wire hook attached to the wall at one end of the rewind bench can be used to keep leaders off the floor when splicing in single trailers, date strips, *etc.* With the reel on the rewind, the leader is unwound by hand and hung up in loops by slipping a sprocket hole over the hook. This saves time and keeps the film clean.—J. D. STEELY, *RCA, Pittsburgh, Pa.*

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Small P.M. dynamic speakers can be used for microphones, and the quality is excellent. Use the transformer mounted on the speaker to match the input impedance. Mount the speaker on springs to prevent noise.—J. A. DAY, *ALTEC, Detroit.*

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Cut the top and bottom out of a vegetable can, leaving the flange on both ends. Remove sharp edges and paint dull black. Cut a cardboard shim to fit can to objective lens. Keeps front surface of lens free of dust. (P.S.—Remove vegetables!)—J. A. DAY, *ALTEC, Detroit.*

• • •

For spare tubes: Use a piece of clear white pine 16½" by 2½" by ¾". Cut ¼" notches at ends to fit between brackets on front of 43-A amplifier. Drill 4 sets of 3/16" holes to match tube prongs of 242-C tubes. Paint black and

install. Spare tubes may now be mounted in a handy position for emergency use. Amplifier and rectifier tubes are separated and easily identified, and valuable space in spare parts cabinet can be put to better use.—J. A. Day, *ALTEC, Detroit.*

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Came across an extremely aggravated case of flutter during a recent routine call. The soundhead in use was type MI-1015-F (PG-70 System), although this trouble could occur on systems incorporating the PS-21 or PS-22 sound heads. The effect was noticeable on music only and appeared as a superimposed 50-cycle ripple. (The power supply in this instance is 25 cycles.)

The tension of the belt driving the sound head was loosened and the trouble entirely disappeared. The belt evidently was passing motor vibration on to the flywheel and thence into the sound mechanism. The projectionist had tightened these belts a week previously—H. Montagnes, *D. S. E. L., Canada, Via ALTEC.*

• • •

I notice from time to time that some of the boys are greatly troubled by wax and emulsion "cake." I have had the same trouble, especially on Metro News prints. Preparing a solution of 2 ounces of ammonia and several drops of eucalyptus oil, I apply this with a small "eyebrow" brush occasionally and eliminated the trouble. The ammonia cuts the wax, and the oil lubricates the surface. Of course, the sound slit should be cleaned regularly as usual, in addition to this treatment. — Walter Dunkelberger, *Fargo, N. D.*

• • •

To eliminate "gear ring" on the W. E. 206 system, Altecman L. A. Zietleman tried the following: Drill three holes in the gear faces (half way from the center to edge and, of course, equidistant), then fill the faces (low portion) with lead. Machine the surfaces level and smooth. This eliminated all "gear ring" trouble for us.—Walter Dunkelberger, *Fargo. N. D.*

• • •

Occasionally, tube-type rectifiers fail to give steady output voltage and at times the bulb filaments may fail to heat properly. One common cause of this, and one that is difficult to locate, is high resistance in the tube socket. In many types of sockets the terminals are screwed to the socket shell and the screw is covered with a wax compound. In case of fluctuating output, with good tubes in use, check all contacts between component parts of the sockets and make sure that the assembly screws are very tight.—M. E. Wheaton, *RCA, Boston.*

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Radio interference on a PG-116 equipment. Investigated an interesting case recently. This particular trouble persisted since the equipment was installed and the source was discovered only by accident. The interference previously had been attributed to defective power lines. In the instance cited here,

the radio interference was caused from the MI-1500 power supply associated with a PG-116 sound system, the strongest interference being in the vicinity of 700 kilocycles.

• • •

A 0.1 mf., 600-volt condenser was placed across the 110-volt input to the power unit and cleared up the interference. Since one side of the 110-volt supply is naturally grounded, this condenser was placed between the hot side of the line and ground at the primary terminals of the power transformer.—J. E. Tagg, *D. S. E. L., Canada, Via ALTEC.*

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RCA h.f. mechanisms, such as the MI-1428 and MI-1443, have speech coils which should measure from 3.0 to 3.2 ohms. I keep a record of these coil resistances and replace them as soon as they increase 16% in resistance. The reason is that the leads are fine copper wire braided around a silk thread. All strands can be broken and the unit will still keep on working as they (the strands) are held in place by the thread and overlap enough to make a contact.—J. A. Cook, *ALTEC, St. Louis.*

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The other day I answered an emergency call which reported loss of sound and no reading on the meter of the main amplifier. The trouble was caused by an accumulation of carbon dust between the laminations of a wafer-type socket. The carbon dust eventually short-circuited the rectifier high voltage contacts of the socket and caused the amplifier to continually blow fuses.

All electrical apparatus should be periodically cleaned of the fine film of carbon dust which in time settles over everything. — C. M. Lane, *ALTEC, Springfield, Mass.*

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Watch out that you don't get called out of bed on a case like this: The theatre was playing "I Wanted Wings". It was reported that there was a pronounced hum in the background of talking sequences. The hum was caused by aeroplane motors, scenes of which did not appear on the screen. — E. A. Briggs, *ALTEC, Kansas City, Mo.*

• • •

One of my theatres reported that their 18-volt motor generator was intermittently flashing internally. I found the trouble to be due to the centrifugal switch closing at times. The proper correction, of course, was to dismantle the motor generator, and clean and adjust the centrifugal switch.

However, in order to prevent an interruption of the show I found that by pressing in against the end of the shaft with a block of wood I was able, by virtue of the endplay in the shaft, to force the armature and the centrifugal throw-out mechanism far enough away from the centrifugal switch to prevent the switch from closing intermittently and flashing.—F. J. Homsher, *ALTEC, North Hills, Pa.*

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Soundhead door latches which often break can be purchased from even the smallest neighborhood hardware store for 5c each.—J. A. Cook, *ALTEC, St. Louis.*

• • •

A damp rag with a little oil on it is very good for polishing the enameled parts on the projectors and soundheads.

Before trying to clean the front surface of a screen with a screen brush, go all over the back with a vacuum cleaner. This will clean out the holes of all dust and any soot that might be pulled out of the holes with the brush, which would streak the screen.—Frank Hamre, *RCA, Pittsburgh, Pa.*

Photography's First Century as a Science and an Art

THE picture of a bullet passing through an electric light or a man jumping from a sixteenth story window, a lovely nude in light and shadow or a sunrise from a mountain pass—that's photography, 1941. But it was only one hundred years ago, in 1841, that Joseph Petzval developed the lens that made photography a possible art instead of a stunt, according to an article in the current issue of *Esquire* reviewing photography's first hundred years. For since the days when Daguerre set his "victim's" head in an iron clamp to hold it still during the twenty minutes need for a single portrait exposure, since the days of Fox Talbot and David Octavius Hill, photography has become a science and an industry.

"Although the earliest inventors," says the *Esquire* article, "realized that speed in photography depends on three variables: the amount of available light, the aperture of the lens and the sensitivity of the photographic emulsion, the first experiments and improvements were almost entirely directed toward improving the lens construction. Zeiss made a big contribution to this field when, in 1890, he put on the market the first anastigmat lens, which, roughly speaking, bade farewell to the mist and haze of the early days. Soon after, in England, H. Dennis Taylor invented a lens called the 'Cooke' Triplet which soon rivaled the German anastigmats in sharpness and speed."

The Chemical Side of Photography

After these improvements in lens construction, chemists began to work on the emulsion, though, curiously, it wasn't until much later that anyone thought of doing anything with artificial light sources. "By far the most significant contribution to the chemistry of photography," the article continues, "was made by Ferdinand Hurter and V. C. Driffield who took the whole darkroom out into the light when they developed a gadget for calculating exposure. They called it the Actinograph, and with this they showed, among other things, that the density of the image is proportional to the mass of silver obtained."

Development of color-sensitive emulsions was the next hurdle to be leaped, and although by 1906 commercial panchromatic plates were on the market, color work was usually beyond the reach of the amateur until Leopold Mannes and L. Godowsky developed a film with three layers of color-sensitive emulsion, each separated by a layer of pigment which acts as a filter. Perfected by the Eastman Kodak Co. and christened "Kodakchrome," this film went on the market in 1935, making amateur color photography as simple as black-and-white.

In 1925 came the miniature camera when Dr. Oskar Barnack, a German manufacturer, developed the Leica, almost accidentally, while making a small camera to test motion picture film. The Leica, built with the utmost precision, enabled the photographer to get pictures of extreme sharpness and quality—it brought art to photography and photography to thousands.

But today photography is more than an art, concludes the article. While art photography is tracking down the bizarre, the dramatic and the exotic, scientific photography is being used for laboratory investigation, for identifying bacteria, broken bones, gun emplacements and criminals. Since Eastman coined the slogan, "You press the button, we do the rest" and gave his camera the name "Kodak" because it sounded like the click of the shutter, photography has come a long way. And, they say, the first hundred years are the hardest!

Settle Pacent Damage Suit

Echoes of the infant days of sound motion pictures reverberated in N. Y. Supreme Court recently when Justice Ben Schreiber approved the payment of $150,000 in settlement of the years-old $6,000,000 treble-damage, anti-trust suit of Stanley K. Olden, as assignee of Pacent Electric Co., against Erpi, Western Electric Co., and A. T. & T. The suit followed the usual pattern of the many similar actions in charging a monopoly in the theatre sound equipment field by virtue of which, it was alleged Pacent was forced out of business.

PARAMOUNT NETS 5 MILLION

Paramount estimates its earnings for the second quarter ended July 5, at $1,904,000 after interest and all charges including provision for all Federal taxes, normal Federal

income taxes being computed at 30 per cent. This amount includes $231,000 representing Para.'s direct and indirect net interest in the combined undistributed earnings for the quarter of partially owned non-consolidated subsidiaries.

Earnings for the six months ended July 5, on the same basis are estimated $4,379,000, including $881,000 share of undistributed earnings of partially owned non-consolidated subsidiaries.

NOVEL STRONG LAMP BOOK

Exhibitors were reminded of the Gay Nineties recently when they received an unusual mailing piece on Strong projection arc lamps from their Independent Theatre Supply Dealer.

Printed on old-fashioned wallpaper of nightmarish design and color, the folder was captioned "Buggy Whips, Base Burners and Low-Intensity Lamps." It detailed the experiences of an exhibitor who thought his eyesight was failing because the pictures on his screen were getting dimmer and dimmer; told of all the changes in projection which have taken place since he installed his low-intensity lamps, and what he did about it.

Old-fashioned woodcut style illustrations were used to illustrate the text. Type styles, popular in the Nineties, also were employed.

ROYALTY-FREE TRAINING FILMS

Both ERPI and RCA will waive all sound recording royalties for Army Training Films produced by the Academy Research Council for the War Department. The sound equipment companies thus become participants in the Council's non-profit training film production program upon the same basis as the participating studios, thus resulting in a considerable saving in the cost of the training films.

CIO QUITS DETROIT THEATRES

Threatened jurisdictional fight between I. A. and the C. I. O. in the Detroit theatre field has been averted by the withdrawal of the C. I. O. charter granted to group representing ushers, doormen, candy girls and cashiers and the transfer of all members therein to I. A. Local B-179. This unit, the charter for which was issued by I. A. about three months ago, now numbers 800 members out of a possible 1000.

Negotiations with the theatres are now under way, with the Union asking for a minimum scale, a maximum hour level, and a closed shop.

BONHAM, PONTIAC, KILLED

Russel Bonham, business representative of I. A. projectionist Local 620 (Pontiac, Mich.) was killed recently when a bolt of lightning struck his lakeside country cottage.

ELECT BROOKS 31st TIME

Harry M. Brooks has been elected president of projectionist Local 285, of Troy, N. Y., for his 31st term. Also named were C. H. McCarthey, v.-p.; L. E. Rinn, fin. sec.; G. L. Nugent, rec. sec.; J. A. Ross, treas., and T. Norris, sgt.-at-arms, the latter for the tenth consecutive time.

MARTENS, L. U. 650, ON THE MEND

Arthur Martens, president of Westchester, N. Y., Local 650 of projectionists, is on the mend following a particularly severe siege of pneumonia.

EASTMAN PROFITS UP 67%

An increase of $16,509,534 in sales for the first six months of 1941 over the same period last year is reported by Eastman Kodak Co. and subsidiary companies in the Western Hemisphere. Total sales amounted to $73,525,058, of which $63,728,339 were in the United States. Increase is equal to 29 per cent for all sales and 33 per cent for those in the U. S.

This substantial increase resulted in a profit, before provision for income taxes, of $20,252,899 as against $12,092,274 last year, or an increase of 67 per cent. From this profit there was deducted an amount of $7,292,474 to provide for income and excess-profits taxes. A further deduction of $2,500,000 was made to take care of the probable increase in taxes that will result from enactment of the Revenue Act now before Congress. This provision for taxes of $9,792,474 compares with $2,913,104 for the six periods of 1940.

NEW RCA VICE-PRESIDENTS

Meade Brunet and Jay D. Cook have been elected Vice-Presidents of RCA Manufacturing Co. Mr. Brunet, whose service with RCA and predecessor companies dates from 1919, will continue his present duties as Manager of the Engineering Products Division, including U. S. Government business. Mr. Cook, whose 14 years with RCA and a predecessor company began in the cost-accounting department, will continue in charge of the International Division.

RECENT ADVANCES IN NON-REFLECTVE LENS COATING

(*Continued from page* 15)

a dark object surrounded by a bright background is viewed through the lens by an observer in the dark, a good demonstration is obtained of the benefits of this treatment. The untreated half of the lens is seen illuminated by light from the bright background reflected and re-reflected between the untreated surfaces. The treated half is dark, however, since any light that reaches the eye has suffered at least two reflections from treated surfaces, and is, therefore, reduced to 1/64 of the intensity of the light from the untreated surfaces.

This demonstrates perfectly the reason for the improvement in picture quality obtained with treated lenses. The photographic film is no longer confronted with the glare of light reflected to it from the several surfaces of the lens.

Reduced Surface Reflectivity

A result of the research program not as yet made available to the public is an improvement in efficiency that has been found possible. The reflectivity of surfaces can be reduced from the present low value of 12.5 per cent [counting untreated surfaces as reflecting 100 per cent] to as low as 9 or 10 per cent. This may seem at first to be trivial, but actually it is relatively important. Samples with this new low reflectivity can be distinguished instantly from the others.

It appears that this low reflectivity can be supplied with a film hardness as great as that described previously. As soon as more searching tests have been made and the results found satisfactory, this improved coating will also be made available.

With such satisfactory results as these appearing in the short space of one year from only one laboratory, the future of the lens-coating process should be very promising.

Certainly other improvements will be made from time to time. Still greater efficiency will be obtained, methods of treating larger and larger surfaces will be developed, and in the space of a few more years uncoated lenses will probably be things of the past. However, although the ultimate is not yet achieved, the process is so much improved over what it was a year ago, it should find wide application in a multitude of fields.

DISCUSSION:

Dr. Carver: At a demonstration last year in New York, of motion pictures projected with lenses coated with non-reflective layers, the most obvious effect was that of an increase in contrast. Now, the processing laboratories have worked out their methods of processing to give a contrast that they believe to be the most pleasing, using standard equipment. Do you know whether the laboratories have found it necessary to change their processing conditions in order to compensate for the increased contrast obtained with the treated lenses?

Dr. Turner: In some cases a change in processing methods was necessary, but it could be very easily accomplished.

Mr. Joy: Has moisture any effect upon these treated surfaces?

Mr. Cook: Not on the outside surfaces of the lenses, which are treated by a method that produces a very durable film on the glass.

NATIONAL THEATRES-RCA PACT

For the sixth consecutive year, the more than 300 theatres comprising the National Theatres Amusement chain are to be serviced by RCA sound engineers, under agreements just signed by the chain and RCA Photophone. Theatres of the Fox West Coast, Evergreen State Amusement, Fox Intermountain and Fox Wisconsin circuits are included in the pact.

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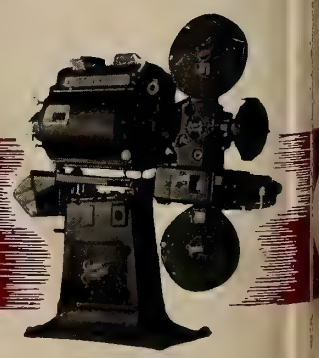

INTERNATIONAL

PROJECTIONIST

FRG

AUGUST 1941

VOLUME 16 • NUMBER 8

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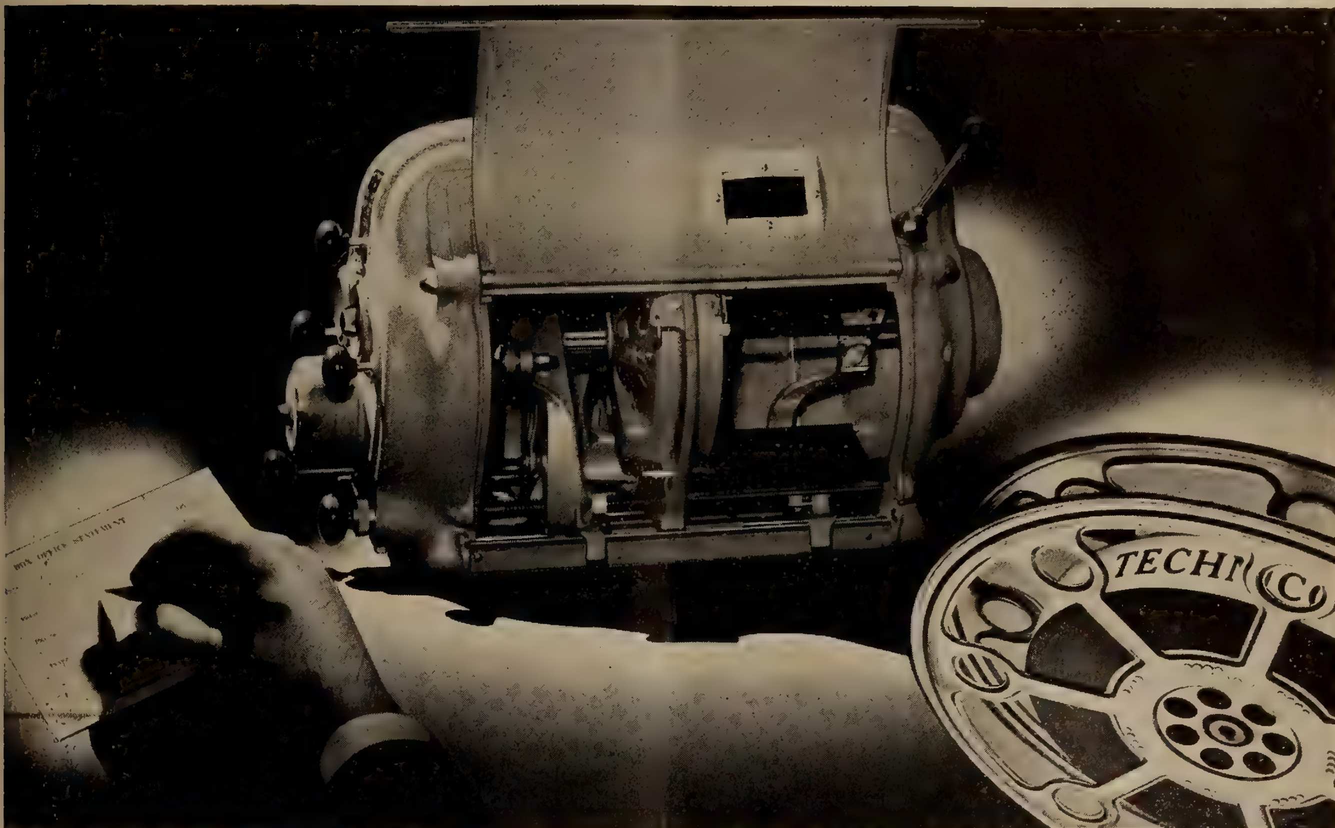
TO PROJECTIONISTS!

Visitron cells are available for every type of sound projection equipment. Theatre supply dealers can advise the correct cell for your equipment. Buy from your supply dealer. If you wish to have your old cells tested without charge, write to G-M Laboratories, Inc., for instructions for shipping. Information furnished promptly.

A sign your lamps are letting you down



• The next time you show Technicolor at the same time as your competition, check up! See whether he is outgrossing you. If he is, here's a tip.

It's probably due to the fact that he has seen the wisdom of installing high-intensity projection lamps, for only with them can you hope to attain satisfactory projection of Technicolor pictures, or of present dense black-and-white prints, for that matter. And people do know where they enjoy seeing pictures most!

The light of your low-intensities is too dim and of the wrong color for good projection. To secure the desired screen brilliancy twice as much light is required as is possible to preject by any low-intensity lamp. So why risk further loss of patronage? Place that order today for Strong Utility One Kilowatt High-Intensity Projection Arc Lamps. They project twice the volume of light at an increased combined current and carbon cost of less than 2c an hour. The snow-white light secured by this new lamp makes the low-intensity appear a muddy yellow by comparison.

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

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Monthly Chat

CONSTANT cause for wonderment, when reading reports of projection room fires, are the reasons ascribed for such occurrences: "cause unknown; carelessness on the part of the projectionist; the film 'exploded': a splice pulled apart"—these are but a few of the variety of vague reasons advanced for happenings fraught with grave danger for hundreds of persons, and most of all for the projection crew.

Oddly enough, there never creeps into such reports even the slightest hint that defective equipment, the result of years of no attention, or the shortcomings of exchange inspection might be responsible for such occurrences. Which brings us back to our pet suggestion that a full report on a pre-show inspection of every foot of film that is to be run, with a carbon copy of same to be retained by the theatre, might be a very handy record to have on hand when the exchange presents a bill for destroyed film.

• • •

The attention of those who held lightly repeated warnings anent the imminent shortage of projection equipment, and of those who had it figured as an attempt by manufacturers to provoke a buying stampeded, is directed to two current trade news items, as follows:

First, all film exchanges have been advised of a serious shortage of reels, film cans and shipping cases, and have had specific instructions bearing on extremely careful handling and conservation of same. Second, Hertner Electric Co. is spending its advertising money to advise that it has been "called to bat by the Government" and is requesting that its customers be patient on deliveries. Not to mention the fact that the paper mills are practically insulting their customers in an effort to avoid taking an order. So . . . ?

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Eastern projectionists might make a note of the SMPE Convention at the Hotel Pennsylvania, N. Y. City, Oct. 20-23, inclusive.

• • •

Manufacturers advise that reel-end signals are rapidly gaining favor with projectionists as insurance against missed changeover cues. Which reminds us that the current survey of projectionist opinion anent proposed changes in the S.R.P. will likely reveal almost unanimous agreement that most projectionists disagree sharply on this matter.

• • •

The thrilling story of the production and exhibition of "Fantasia," one of the greatest technical achievements of the motion picture art, is presented herein. Here is a yarn that will give every real craftsman almost as much of a thrill as would the actual viewing of this masterful blending by some of the best technicians extant of glorious music and delightful drawings.

INTERNATIONAL PROJECTIONIST

VOLUME XVI AUGUST 1941 NUMBER 8

Advance Signs of Reproducer Trouble

By *LEROY CHADBOURNE*

MANY of the troubles that cause breakdown in sound systems, or expensive repairs, give warning signs in advance. One purpose of skilled, careful routine inspection is to turn up such warnings so the necessary adjustments can be made before anything happens. But there are many trouble signs that the projectionist can catch in the course of his day's work merely by keeping an eye open for any unusual functioning in the system. Now more than ever before such close attention is desirable, because replacement parts may contain substitute materials.

Most circuits, and their component parts, are subject to troubles peculiar to themselves, and give their own special kind of advance warning. But one form of warning symptom is practically universal. Regardless of the part or circuit, wherever overheating is found it means impending trouble. Note the word *overheating*. Many parts work hot normally, and are intended to; the larger tubes, for example, and some types of sulphide rectifiers. The distinction to be drawn is that between heating and overheating.

A thermometer is a useful and inexpensive gadget to have about the projection room, though little used. The common baking or cooking thermometer, which reads above the boiling point of water, is best. However, the projectionist who knows his system and just how hot every part should become normally can judge pretty well when overheating grows serious. Important is the fact that in a crowded amplifier or other enclosed cabinet it may not be the part that overheats which breaks down first. Some adjacent part, or perhaps the insulation of the wiring, may be the first to give way. Overheating is thus not only a very common symptom of trouble but also a common cause of it.

Overheating is a result of excess current relative to the resistance through which it flows. Thus it can have many causes, and the part that overheats most seriously is not necessarily the part at fault. A rise in voltage, of either the power line or the voltage applied across one particular part, may be responsible. Where there are several parts in series in a given circuit, lowering of resistance in one may cause overheating in another. Voltage drops throughout that circuit may be traced with a voltmeter to find where the trouble has its start.

Spotting Defective Tubes

There is another cause of overheating which is not electrical, namely, a change in the conditions for ventilation of the cabinet or panel in which overheating appears. Temporarily or permanently placing some object in a position to block the flow of air through the vents of that panel has been known to produce overheating and subsequent electrical breakdown.

Overheating will be considered further in connection with trouble symptoms shown by individual parts.

A number of modern tube types are little subject to burning out. The cathode-filament structure is so made that the tube continues to light even after emission has become too weak to be of much use. Some tube types still burn out. In any tube a bright spot on the cathode or filament is a trouble sign. That's where the tube will burn out if it can, or lose its emissive powers even if it can't burn out. Change at once any tube in which you see a spot on the cathode or filament notably brighter than neighboring parts of the cathode.

Low emission in a tube is shown by low reading of the plate current meter. It is not always a serious fault. Tubes used in push-pull or full-wave, in which one shows low emission, should be changed but need not be discarded in all cases. Tubes used in such circuits should be paired to secure the same plate current through each. A pair of tubes of relatively low emission may give perfectly satisfactory results. The manufacturer of the amplifier or rectifier—not of the tube—will designate the lower limit of emissivity beyond which the tube should be discarded.

Gas in an amplifying tube is a seri-

ous matter. The ionized molecules of gas will bombard the filament or cathode, destroying it or reducing its emissivity. Meanwhile, gas will impair sound quality. The warning symptom of gas is a bluish glow inside the tube. Where the tube contains gas it acts in a way like a fluorescent lamp giving off a faint bluish light. This light flickers with changes in sound volume, that is, with changes in the current passing through the tube. Some tubes, however, are made with glass that gives off this bluish glow normally.

It is important to observe the tube carefully to determine whether the glow is *inside* or only around the inner surface of the glass. The latter phenomenon is harmless. Lastly, a tube that seems gassy may really be exhibiting a different type of trouble. No vacuum is perfect: all tubes contain some residual gas. The larger types may become so hot that the gas is driven out of the crevices in which it had previously been hiding by adsorption. In such cases symptoms of gassiness do not necessarily indicate a faulty tube but one which, through its own or some other defect, is overheating.

Tubes become noisy through imperfect mounting of their internal parts, a condition which may be induced by rough handling. Tapping the tube, and noting whether the noise produced in the speakers is abnormally loud or prolonged, will indicate such a defect. If so, the tube must be replaced, but not necessarily discarded. It may prove useful in some other socket where it is subject to less vibration or where its noise output is subject to less amplification.

Checking on Resistors

Resistors are of two general types, composition and wire-wound. This distinction applies also to variable resistors, such as rheostats, potentiometers and other controls.

The composition-type is likely to contain conducting particles, usually carbon, embedded in a cementing material. The cementing materials used are partial conductors and their composition is varied according to the resistance desired; also, the proportion of particles to cementing material may be varied, or the particles omitted entirely. In this way any desired resistance can be obtained irrespective of the physical dimensions of the unit.

Sometimes, especially when exposed to heat, the composition changes somewhat by drying. This may increase the resistance, causing the unit to work hot, which in turn produces further drying, and so on. The resistor is not as likely to burn out as to become noisy. There is no remedy except replacement. An ohmeter reading of a suspected resistor should show no departure from rating value of more than 10 per cent.

The variable-type composition resistors commonly consist of a plate of resistance material over which the contact point slides. By drying out, by friction, or by rough handling, the thin plate of conducting resistance material, often a graphite composition or pure graphite, may develop cracks. These will make the unit noisy when adjusted. They will also grow larger, making the unit still more noisy, and finally unusable.

A unit of this type which is noisy to adjust should be inspected internally. If the trouble is merely bad contact by the slider, or bad contact to the slider shaft, it can be adjusted. If the trouble is in the resistance element, the unit should be replaced without delay. Some of these units are so made they can't be opened easily for inspection and adjustment. In that case, discard the unit when it becomes noisy. They are not expensive.

Wire-wound resistors are themselves of two types—bare wire and wire embedded in porcelain. The purpose of the porcelain is to carry away and radiate the heat produced by operation, thus making possible use of a smaller resistance unit. In either type prolonged overheating, or a temporary surge of high current, may burn out the resistor wire. Sometimes the gap caused by the burn-out can be bridged by a jumper, and the unit continued in use. Generally, it is best to replace it.

In the bare-wire type the resistance wire may be wound on a composition core, and the core may give way through prolonged exposure to high temperature, cracking or crumbling, thus ceasing to offer a firm physical support to the wire coil. Where this is seen, even in small degree, the unit should be replaced at once. Otherwise continuation of the process will allow two adjacent turns of wire to touch, short-circuiting their resistance. An excessive current will then flow, with danger both to the resistance wire and to other parts of the same circuit.

If, nevertheless, the unit is kept in use under the same conditions of high temperature, other portions of the composition core will crumble and many turns of wire will be touching their neighbors; or the whole coil may collapse, with disastrous consequences. Replace the unit at the first sign of this trouble.

In wire-wound composition units the first sign of trouble may be roughness or noisiness in making adjustments. This happens when the core on which the wire is wound so shrinks or distorts, because of heat, that the coil no longer presents an even surface to the contactor. Although a wire-wound variable control which presents this condition on inspection can sometimes be kept in use for months longer, it is dangerous to do so; it should be discarded at once.

Condensers are of two types, electrolytic, and paper or mica. The electrolytic type are subject to some degree of drying out [less now than in older models]. Where an electrolytic condenser is used in a filter circuit, drying out is signalized by a gradual increase in the background hum of the sound system. There is no cure except installation of new condensers. The trouble is progressive, and the identifying hum will slowly become more pronounced.

The mica type of condenser, in which the insulation consists of a tarry substance, may show the effect of prolonged

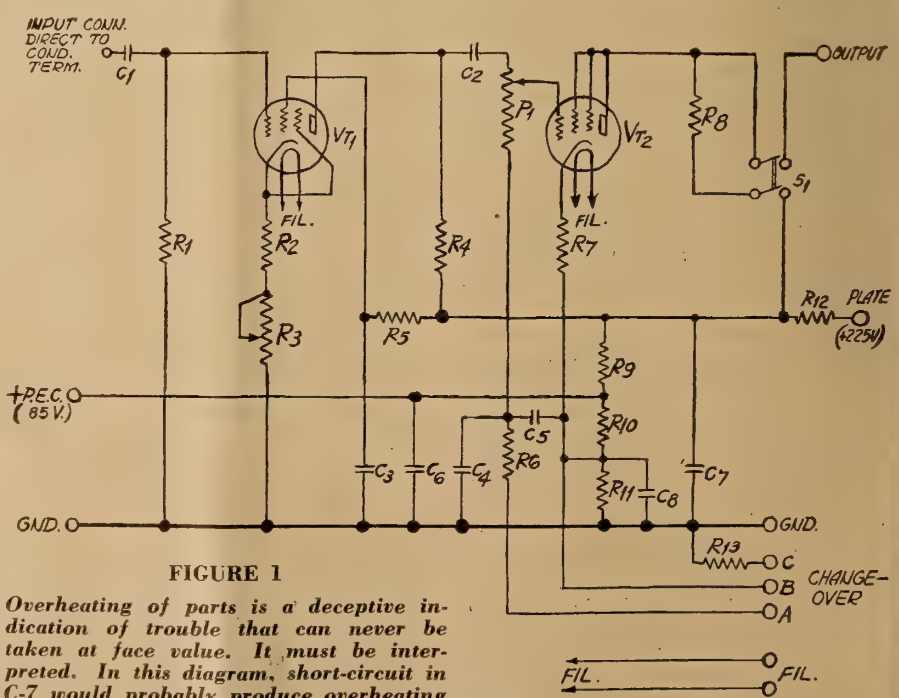
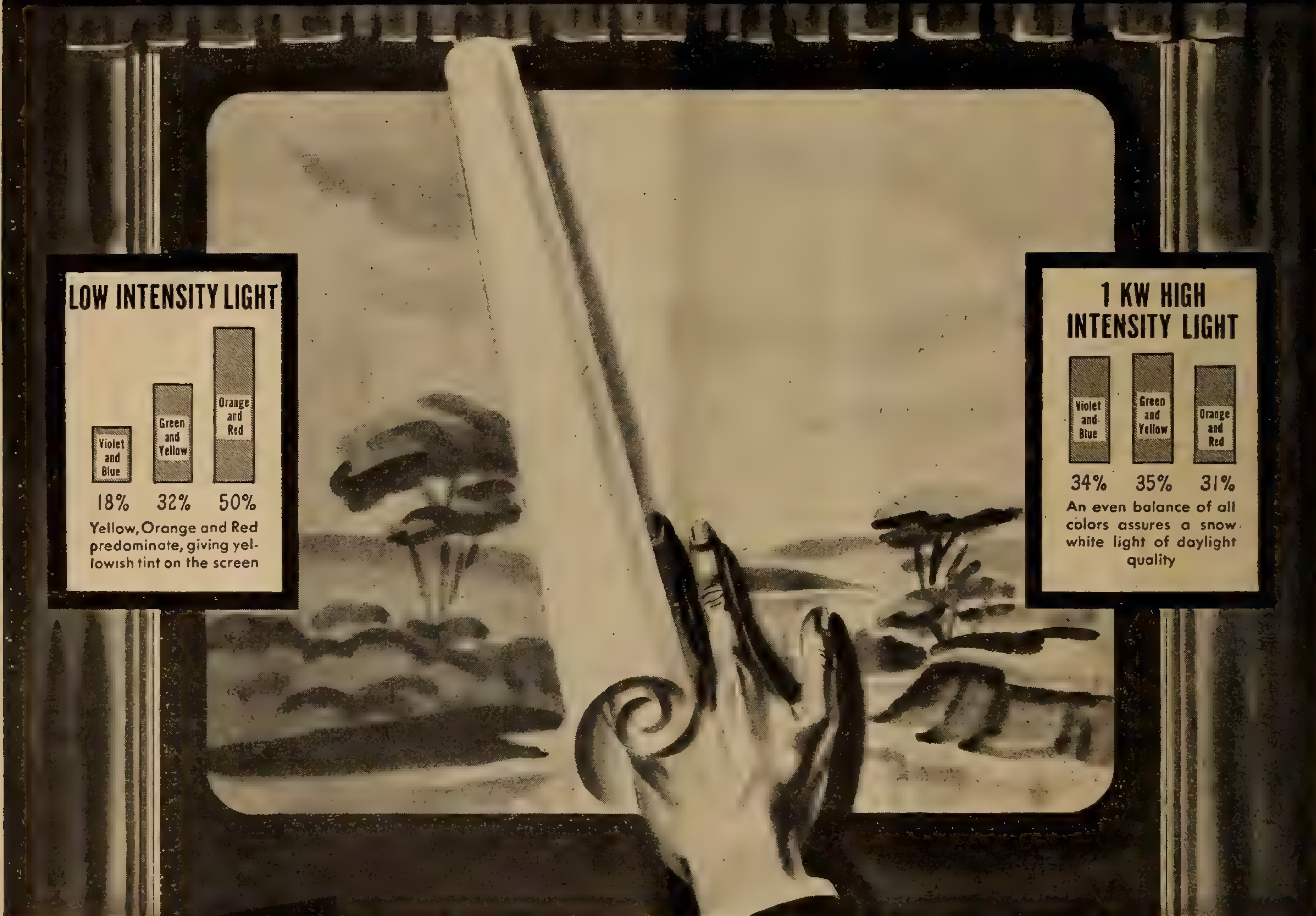


FIGURE 1

Overheating of parts is a deceptive indication of trouble that can never be taken at face value. It must be interpreted. In this diagram, short-circuit in C-7 would probably produce overheating in R-12; short-circuit in C-6 would likely overheat R-12 and R-9, etc.

Replace that yellow tint with snow white light



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exposure to heat in a boiling out of the tar, which bubbles or oozes out of the case of the condenser. This loss of resistance material in the interior alters the capacitance, and in time may reduce the internal resistance to the point where a flashover and burn-out can occur at normal operating voltage. Condensers which are losing tar to any serious degree should be replaced.

Coils and Transformers

Over-hot operation is the principal external sign of impending trouble in these parts—but it must be remembered that many power transformers and some filter chokes are intended to and do operate hot. Here is where a thermometer is particularly useful, since the manufacturer can designate the same temperature rise of a given transformer. When this is exceeded, the cause may be external and lie in undue rise of the applied voltage; but it may also be internal and consist of a short-circuit of some turns of wire, resulting in increase of current flow. Finally, the cause may also be external in the sense of lowered resistance of some part in series with a choke coil, or in a shunt to a transformer secondary.

It is often impracticable to open a transformer to inspect the condition of its coils. If all external conditions are checked and shown to be normal, if ventilation is checked and found normal, the coil is commonly considered at fault. This may finally be checked by installing a replacement and observing whether it operates at normal temperature. Ohmmeter tests of the transformer windings will disclose any glaring short-circuit; but one that results only in decrease of the inductive reactance may not be very evident to an ohmmeter check. However, every recourse is exhausted before a large power transformer is replaced. They are expensive, and, being expensive, are so built that they very seldom cause trouble. Suspect everything else first.

A somewhat more common fault in transformers and chokes is loosening of the bolts that hold the core laminations together. If the laminations are loosened enough to allow them to vibrate, hum in the reproduced sound will result. The remedy is physical inspection and tightening of the bolts as soon as slight hum, due to this cause, appears. The smaller models are held together by rivets, not bolts, and do not produce trouble of this kind.

Sockets may give trouble by loss of the spring tension with which they make contact to the prongs of the tube. Poor contact may produce noisy sound, or even in some cases sparking between prong and socket contact. Dirt in the socket will produce similar results. Whenever a tube is suspected of being noisy, or shows signs of it on tapping the tube, the socket also should be suspected. Inserting and removing the tube three or four times will usually clear any dirt in the socket; the prongs of the tube may be inspected and cleaned with carbon tetrachloride or very fine sandpaper—*not* emery. If the spring contact has weakened [less likely in new socket types] the socket may have to be replaced. Noisy sound is the warning.

Another trouble of some socket types is breakdown of the material on which the contacts are mounted, much in the same way that some resistor cores break down under the heat of prolonged operation. Any undue difficulty in inserting or removing tubes, or any undue shakiness of the tube in its socket, whether noisy sound follows or not, calls for inspection of the socket insulating material, and prompt replacement of the socket if any fault of this kind is found.

Wires and Insulation

Prolonged exposure to heat may cause deterioration of thin strands of copper wire, depending principally on industrial gases that may be present in the atmosphere. Sulfurous gases, for example, are harmful to copper wire. Signs of blackening of exposed strands call for relatively frequent inspection and, possibly, replacement of the conductor.

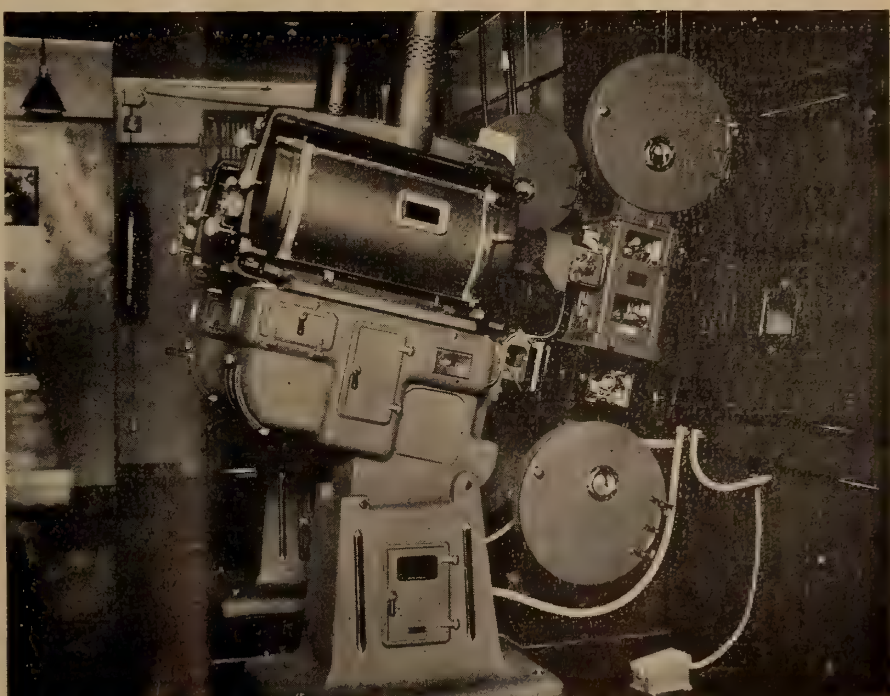
Prolonged exposure to high temperature may produce crystalline changes in copper wire, making it brittle rather than flexible and leading it to break under conditions of even moderate vibration. Exceptional stiffness in a thin copper wire is a warning sign, indicating that an open circuit may follow at some time or other and that replacement of that wire or of a section of it may be desirable.

Heat also causes some types of rubber insulation to become hard and to crack, exposing the conductor. Where this condition is found in a location making short-circuit possible because of exposure of the wire, replacement is indicated. Oil on rubber insulation calls for replacement more frequently. Many types of rubber will deteriorate, with resulting possibility of noisy sound. It is somewhat common practice, where this condition is found in a sensitive part of the sound system—a part followed by much amplification—to consider oily rubber a warning of noisy sound to come, and to replace it.

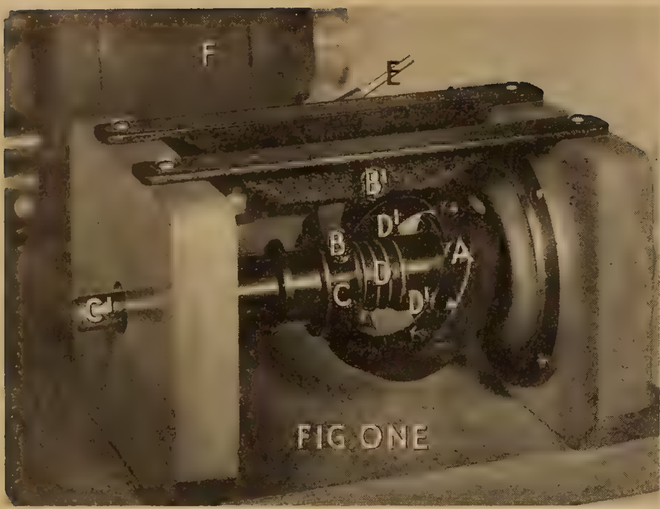
4½ MILLION WARNER PROFIT

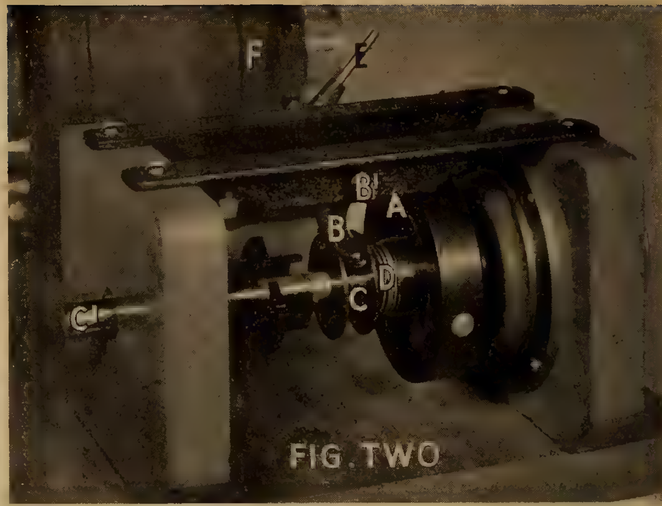
Warners and subsidiary companies report for the 39 weeks ending May 31, a net operating profit of $4,433,445 after deducting all charges including amortization and depreciation, a provision for contingencies amounting to $914,000 and normal Federal income taxes, as compared with a net operating profit of $2,450,713, after a provision of $175,000 for contingencies, reported for the corresponding period the previous year.

Earnings are equivalent to $4.50 per share on 99,617 shares of outstanding preferred and, after allowance for current preferred dividend requirements to $1.12 per share on 3,701,090 shares of outstanding common. Preferred dividends in arrears amount to $33.68 per share.



Recent installation of Simplex High 1-kw. lamps in the Tivoli Theatre, Mishawaka, Ind. Room is presided over by Truman D. Rogers, I.A. Local 187.





All photographs used for the illustrations in this article by courtesy of International Projector Corp.

Mechanics of the Modern Projector

NEW mechanical principles and practices, utilized to obtain modern performance in projector mechanisms, are more readily visualized and understood with the help of special models prepared by International Projector Corp. These models, illustrated herewith, have been displayed in some of the larger cities. They are of two general types. Some consist merely of component mechanical assemblies removed from the projector and operated independently, whereby their functioning can easily be seen and studied. Others are enlarged or otherwise altered mechanical representations of projector parts, built to display the principle of operation with greater clarity and vividness.

Figures 1 and 2, carefully examined, reveal the secret of a ring-type governor.

By *HENRY B. SELLWOOD*

Fig. 1 shows the governor ring at rest; Fig. 2 shows the position it assumes under centrifugal force when the projector is in motion. *D* is the spring that opposes the centrifugal force. Part *B*, riding in slot *C*, is pushed to the left by the action of the spring when the mechanism stops, and is drawn to the right by centrifugal action of the ring when the machine is running. Part *B*, when drawn forward or backward in this way, causes a corresponding partial rotation of shaft B^1, thus altering the position of *E*, which in turn controls the fire shutter.

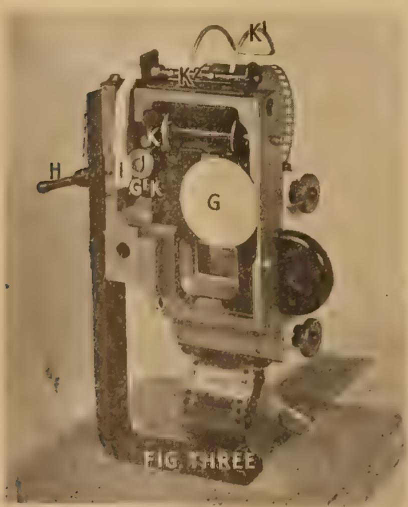
A, seen more clearly in Fig. 1, indicates holes penetrating into but not through the governor ring. Others are located at the opposite side of the circumference, in the right instead of the left surface. The function of these holes is to create an uneven distribution of the weight of the ring: it is lighter where material has been removed by the drilling of holes *A—A*. When shaft C^1 is put into rotation, the ring, mounted on trunnions D^1—D^1, rotates with it, but by the unequal distribution of its weight it is impelled under centrifugal force to leave the reclining position of Fig. 1 and assume the rectangular position of Fig. 2. In doing so it draws slot *C* to the right, resulting, as already explained, in the angular lifting of pin *E*.

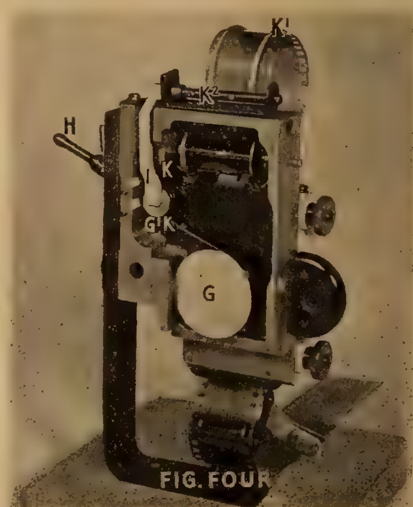
F is the motor which, in this demonstration model, drives shaft C^1. In the actual projector C^1 is the shutter shaft. This type of governor is wholly silent in operation; flyweights can neither chatter nor bind because there aren't any. The ring performs their function in a different and more modern way.

Anent the Fire Shutter

Figures 3 and 4 illustrate the action of the fire shutter—a double action. The shutter is controlled by *both* the governor and the safety device K^1, with the latter overruling the governor and taking control away from it when circumstances require. The shutter itself is *G*, which in Fig. 4 is seen lowered to prevent film fire; in Fig. 3 it is raised to permit projection.

Under normal circumstances *G* can be raised in one of two ways: automatically, through the raising of pin *E* of Figs. 1 and 2; manually, by depressing lever *H* of Figs. 3 and 4. However, lever *H* oper-





ates only under normal circumstances.

Emergency conditions are represented in Fig. 4 by an enlarged upper loop pressing against K^1. What happens next is best understood by looking at Fig. 3. K^1 is pushed up and back, consequently shaft K^2 rotates through about 1/8th turn, and the lower end of lever I is thus caused to push against pin J. When pin J is pushed in, part K falls, and the fire shutter drops with it, covering the aperture.

The normal size of the upper loop is shown in Fig. 3; while Fig. 4 shows the enlarged loop created when the film tears.

Note that in normal operation shutter G is raised or lowered by hinging on screw G^1; it is shown normally lowered in Fig. 1. But in an emergency, when the upper loop is enlarged, the shutter does not fall by hinging on G^1 but because part K drops. That condition is not shown in these illustrations. When it occurs, the shutter cannot be opened again until the motor has been stopped, allowing pin E of Figs. 1 and 2 to fall. Then, and then only, the shutter can be re-set by means of H of Figs. 3 and 4, but if the enlarged upper loop that caused the emergency closing of this fire shutter has not been cleared, the shutter cannot be re-set.

The mechanism of Figs. 3 and 4, in cooperation with other parts of the mechanism, including those shown in Figs. 1 and 2, therefore provides instant protection against aperture fire in case the film breaks; and it compels the projectionist to stop the mechanism and clear the trouble before operation can be resumed. Note also that shutter G is free-falling, does not ride in slots thus, even if it should in time become warped by heat, can never jam.

The Projection Shutters

The double shutter principle is illustrated in Figs. 5 and 6. The two shutters are L, the rear shutter, and O, the front shutter; M takes the place of the projection screen for purposes of this demonstration; N is a projection lens adapted to the needs of the demonstration.

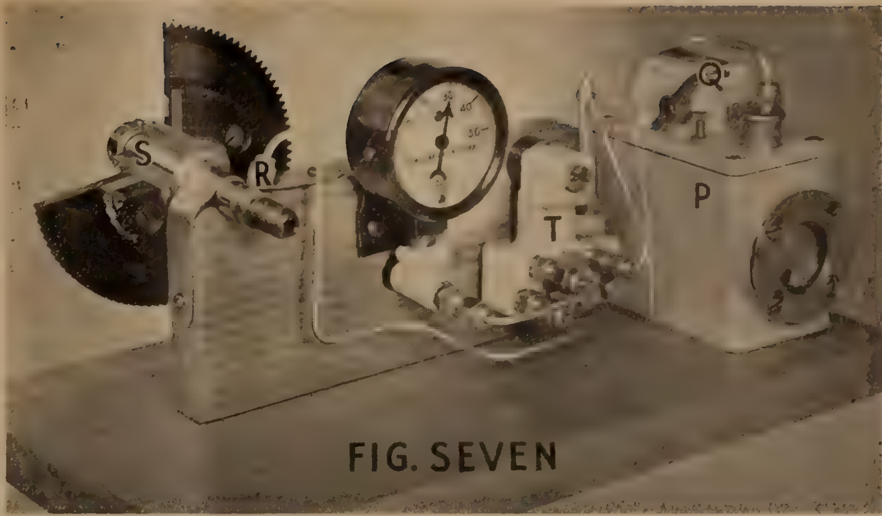


FIG. SEVEN

In Fig. 5 the movable screen, M, is placed between the front shutter and the lens. Hence, the image is projected to the screen without interposition of the front shutter, the effect being that of a mechanism having one shutter only. That single shutter, L, has cut off one-half the light, but the other half of the light beam still enters the top of the aperture and is projected to screen M.

In Fig. 6 nothing has been changed except the position of screen M, which has been moved beyond shutter O to bring both shutters in operation. Note that the blades of shutter O are exactly in line with the blades of shutter L, but the light which in Fig. 5 fell on screen M now falls on shutter O, and the screen is entirely dark. Thus the use of two shutters cuts off the light from the screen twice as fast as can one shutter. The blades therefore can be, and are, trimmed to admit full screen illumination for a longer period of time, thereby increasing the total illumination.

Note also that all the aforementioned facts with reference to Figs. 5 and 6 are independent of whether the shutters in those illustrations are in process of cutting off the light or in process of re-admitting light. Both processes require only half the time needed for single-shutter operation.

In the actual demonstration model another fact is very clearly brought out which cannot easily be illustrated. The aperture is divided horizontally into two parts by means of red and green gelatine strips, with the red above the green. When the light is projected on screen M, however, the green is above the red, since the action of the lens is to reverse the beam of light, as does every projection lens. Hence, in Fig. 6, shutter L prevents light from reaching the green, or lower, half of the aperture, and all the light projected is red light which has passed through the upper gelatine. But the reversing action of the lens deflects this light to the lower portion of the image on screen M, while if any green light at all were admitted, it would appear on the screen above and not below the red.

This explains why the two shutters, front and rear, are exactly aligned, and

FIG. FIVE

FIG. SIX

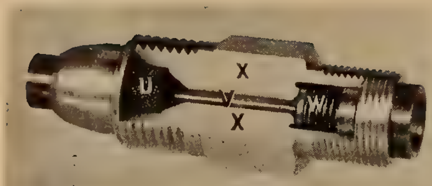


FIG. EIGHT

why they rotate in the same direction. Shutter O, in Fig. 6, is intercepting light which was originally the top of the beam. If shutter O were placed beside shutter L instead of at the opposite end of the lens, O and L would have to rotate in opposite directions, which would involve more gearing and much greater complications in securing proper alignment and trim. There would also be a chance of the two shutters getting out of adjustment with respect to each other.

Mounted as they are, however, at opposite ends of the lens, the front and rear shutters are very simply adjusted [the light-cutting edges being brought exactly in line with each other]; they rotate in the same direction [there are no gears at all between them, they being mounted on the same shaft], and since they are solidly mounted to their common shaft, they must maintain their proper relationship.

The Lubrication System

Figure 7 outlines the general principles of the lubrication system of the Simplex E-7 projector, in which P is an oil reservoir, Q a pump lever, and T a distribution block. The pressure gauge shown in the model is not used on the projector, being added in this case for demonstration purposes. The lubricant, having been put under pressure by pushing lever Q down two or three times, flows, under pressure, to filter R, whence it enters shaft S and emerges between the shaft and the gear through the hole seen in the middle of the shaft. There, still under pressure, it is forced by the lubricant following it to wash away toward the two ends of shaft S. The shaft is in this way supplied with a continuously replaced film of fresh, filtered lubricant, which additionally exercises a washing action, flushing away and out at either end any dirt or metallic particles.

In the actual projector, of course, a number of oil lines leave the distribution block in parallel, conveying lubricant to many bearings and shafts. The necessary pressure is maintained by manipulating lever Q two or three times in a long working day. The reservoir is refilled at long intervals through the oil cap seen just in front of the lever. The sight gauge tells when refilling is necessary.

A second and vital part of the system is shown greatly enlarged in Fig. 8, which is simply section R of Fig. 7 cut away to show internal construction. Lubricant enters Fig. 8 at the right and flows past shaft V after its pressure has overcome the resistance of spring W. The action of the spring, which opposes the pressure of the lubricant, lends assurance that oil flowing through Fig. 8 will flow at the pre-determined pressure. It flows past pin V, which fits very closely in the hole drilled through material X—X.

Both the diameter of this hole and the diameter of pin V are accurately machined; the clearance is pre-determined and the amount of oil passing per minute is thus also pre-determined. Each bearing or shaft to be lubricated is fitted with one of these devices [R of Fig. 7] in which the diameter of pin V has been chosen to admit the correct amount of lubricant for that location.

U in Fig. 8 is a double filter consisting of metal mesh, seen in the photograph, and of a felt filter inside the mesh, which cannot be seen. This filter does not clog because the flow of lubricant is toward the filter—from right to left in this photograph—and any dirt which may have gotten past the filter in P of Fig. 7 does not enter the filter of Fig. 8 but drops away at the surface of U.

PATRONS WILL PAY NEW TAX AT B. O. AFTER OCT 1

The public will carry the load of the new admission tax regulations which went into effect Oct. 1. Major circuits, independent circuits and individual theatre operators indicated that no attempt would be made to absorb the tax. In brief, the tax law applies to all admissions starting with the first penny, except tickets selling for less than 10 cents to children under 12 years of age.

It is reported that Loew's and RKO are contemplating a policy of "even" admissions in order to eliminate the odd pennies. Where the price now is 28 cents with tax, the price would be put up to a 30-cent level if the plan is adopted. This policy has been in effect in 85 per cent of the Skouras theatres for some time, and will be extended to the entire circuit shortly.

New RCA Lens-Coating Process Available

A NEW technique for improving the efficiency of motion picture projector lenses by coating the glass surfaces with a durable transparent film that produces clearer, more contrasting pictures on the screen without the necessity of otherwise adjusting the projector, has been developed for commercial uses by RCA. The process, known as RCA Magicote, is also being employed in Hollywood to increase the efficiency of camera lenses. Finer detail, sharper contrast, and improved color values, all result from the application of this development.

The principle of lens coating is not an entirely new discovery, states the RCA announcement. Scientists have long understood that when a beam of light strikes a pane of glass, not all the light passes all the way through. An average of approximately 4% is reflected at the first glass-air surface, so that only about 96% passes on through to the second. Then another 4% is turned back at the second glass-air surface, so that only about 92% of the light actually passes all the way through and out from the other side. If additional panes of glass are inserted in the light path, each one contributes reflections that similarly turn back and scatter some of the light rays.

High Light-Transmission Loss

In the case of lenses with a multiplicity of elements, such as those employed by projectors and cameras, the reduction in and scattering of the light passing through the lens noticeably impairs the brightness and quality of the projected image. For instance, with a lens having eight glass-air surfaces, the light loss amounts to 30% or more.

RCA further points out that although some of the light rays reflected by any glass-air surface of a motion picture projector lens eventually reach the screen through being reflected back toward the screen by the other surfaces they encounter, they arrive as diffuse light rather than as directed rays which shape up and outline picture details. Thus they tend to wash out a picture in a manner similar to that when diffuse extraneous light is allowed to play upon the screen. In the case of colored pictures, this misdirection and scattering of light rays is particularly harmful, as it tends to mix the colors.

A theatre, if it wished, could also offset the light lost by uncoated lenses by boosting the arc power, but that this means added daily operating costs. Furthermore, this would do nothing toward offseting the harm done by the scattered diffuse light. Only a scientifically-applied coating strikes at both problems and gives improved picture quality along with a more brilliantly lighted picture.

The coating applied to the lens surfaces by the RCA Magicote processes practically eliminates reflections. Its thickness is carefully controlled to be one-quarter the wavelength of visible light or about five millionths of an inch. RCA developed a coating which exhaustive tests show is very durable and at the same time very efficient.

RCA's field force will handle the new lens-coating activity. Lenses are shipped to the RCA plant at Indianapolis, where ample facilities for applying the Magicote surface have been installed in a special air-conditioned laboratory. Application of the coating requires less than three days.

Effect of Static on Sound Systems

METHODS commonly employed in theatres to combat "man-made static" interference can best be understood if the nature of the troublesome impulses is analyzed. They are, usually, radio signals, even when not originating in any kind of radio device. Diathermy machines, which produce so much interference of this kind, are essentially short-wave radio transmitters. Many of them could be heard hundreds of miles away with no other change than connecting their output to a transmitting antenna. It is easily understandable that they can influence vacuum tube apparatus at short distances.

Less generally realized, perhaps, is the fact that any automobile motor is a kind of radio transmitter, putting out a signal at about twenty meters. The radio-frequency generator in the car is, simply, the spark plug. The spark is not a mere D.C. discharge, leaping steadily and smoothly across a gap because of its high voltage. No spark is a simple flow of D.C.

Early wireless transmitters, before the days of radio, used spark-gap generators as their source of radio-frequency current. Actual automobile spark plugs were used by radio amateurs up to about 1920 and affected code transmissions over quite a few miles distance.

Passing automobiles are not likely to trouble the average theatre sound system, simply because the spark and all wires leading to it are so thoroughly shielded by the motor block and car body. Much more troublesome are sparking contacts in flashers and other advertising displays associated with the front of the theatre.

When current sparks across an air-gap it effects an erratic contact, a high-speed, make-and-break contact, generating a high-frequency field. However, a spark never produces a pure or single frequency. The greater part of its energy will be concentrated on or about a frequency determined by the inductance and the capacitance of the circuits carrying the sparking current. The old-time spark wireless transmitters were tuned to their assigned frequencies by adjusting inductance and capacitance intentionally added to their circuits. Spark-type diathermy machines are tuned that way today.

In the case of sparking in flashing sign contactors, generator brushes or other machinery, the bulk of the spark's high-frequency energy will be bunched at a frequency determined by accidental, unavoidable inductance and capacitance of the wiring.

The oscillating discharge is never "sharp": it spreads out over a wide range of neighboring frequencies. Hence, if a sound system is nearby and at all subject to picking up this form of disturbance, there will likely be some sensitive wiring, somewhere associated with that system, with accidental inductance and capacitance capable of responding to one of the many frequencies the spark discharge puts out.

An erratic, irregular high-frequency current will then be induced in such wiring. Since sound equipment is not designed for high frequencies in the sense of radio frequencies—millions of cycles per second—the h.f. induced in the sound wiring will not be amplified or heard in the speakers, but the irregularities or modulation thereof, if of audio frequencies, will come through. The usual result is a rasping, tearing, erratic kind of noise.

This last point should, perhaps, be emphasized. Sound, as every projectionist knows, consists of frequencies from 15 to 15,000 cycles, more or less, and can be represented by electric currents of the same frequency range. Yet sound currents are received by radios tuned to hundreds of thousands or millions of cycles. The radio-frequency current is the "carrier" on which the audio or sound current is superimposed; that is, the audio or sound component constitutes an irregularity in the high-frequency radio current. This irregularity is separated from the radio current in the receiving set, further amplified, and applied to the radio speaker as ordinary sound A.C.

That is exactly what happens when a theatre system picks up a spark discharge as noise: the high-frequency discharge generated by the spark is the carrier, and the irregularities accompanying it are separated from it in the sound system, amplified, and heard as noise.

It is plain from the foregoing that the remedy is to *keep out the carrier.* This is accomplished as a rule by shielding and grounding. Where these methods fail, as they sometimes do, two different remedies remain. One is to stop the trouble at its source, such as by fixing sparking contactors so they won't spark. Another method of stopping the discharge is by connecting a condenser across the contacts: or better still, by connecting each contact to ground through a condenser. This addition, where the condensers are of relatively large capacitance, absorbs and thus suppresses the high frequency generated.

Where the source of the sparking cannot be located, or where it is outside the premises and not under theatre control, another resource is to locate the "receiving" circuit in the sound system and de-tune it so thoroughly that it will no longer respond to the interference. This is usually done by connecting radio-frequency choke coils of appropriate inductance in series with the offending circuit of the sound system.

N.T.S. Head Scores Neglect During "Sellers' Market"

IN RESPONSE to a request for comment on the current "sellers' market," the result of the great demand on materials and manufacturing facilities by national defense needs, Walter Green, president of National Theatre Supply Co., issued the appended statement, which should prove of considerable interest not only to projectionists, exhibitors and supply dealers in general, but also to those manufacturers of equipment who unwisely refrain from promotion efforts at this time and contribute as little as possible to the efficient operation of their equipments in the field. Mr. Green's statement follows:

"One of the shrewdest comments on human nature in business was made recently by a well-known sales executive when he said: 'The basic symptom of a sellers' market is a mounting neglect to cultivate customers.'

"Never must it be said that we at National are guilty of such neglect. It is our duty now, more than ever before, to build for the future, to visualize the day when there will be no so-called 'sellers' market', either real or imagined.

"Customers have long memories. Suppliers who have given them the service to which they are entitled will be remembered and will profit accordingly. The others will fall by the wayside. This is the time to give customers an extra measure of personal service. These are the days when we can cement our present friendships and create new ones.

"National can and will show exhibitors how to get the best out of their present equipment, if new equipment is not immediately available. National can suggest an equipment check-up that will help avoid shut-downs at crucial moments. By being fore-sighted for our customers and for those we want as customers, we can render the kind of service that will pay dividends, not only now, but three, four or five years from now."

'Fantasound': a Technologic Epoch†

By *WILLIAM E. GARITY and J. N. A. HAWKINS*
MEMBERS, TECHNICAL STAFF, WALT DISNEY PRODUCTIONS

Here is the thrilling story of that marvelous technical achievement of the multiple-speaker system known as "Fantasound," currently used for reproducing Walt Disney's "Fantasia," now established after 48 weeks consecutive showing on Broadway as the all-time, all-champ sound motion picture. Technical preparation for this epic production included the exploration on paper of several hundred different equipment combinations, which subsequently were translated into ten different systems before the final form was decided upon. The production of "Fantasia," excluding release prints, required the use of five million feet of film!

In the appended article are discussed first some of the deficiencies of conventional sound-picture reproduction, and then follows a complete history of the "Fantasound" development. In addition are described in considerable detail the various important elements of the system. No technician will fail to be thrilled by this exposition of the planning and execution of one of the greatest technical achievements in the history of the film art.

THE art of sound-picture reproduction is about 15 years old. While an engineer familiar with the complications of sound reproduction may be amazed at the tens of thousands of trouble-free performances given daily, the public takes our efforts for granted and sees nothing remarkable about it. Therefore, we must take large steps forward, rather than small ones, if we are to inveigle the public away from softball games, bowling alleys, night-spots, or rapidly improving radio reproduction.

The public has to *hear* the difference and then be *thrilled* by it, if our efforts toward the improvement of sound-picture quality are to be reflected at the box-office. Improvements perceptible only through direct *A-B* comparisons have little box-office value.

While dialog is intelligible and music is satisfactory, no one can claim that we have even approached perfect simulation of concert-hall or live entertainment. It might be emphasized that perfect simulation of live entertainment is not our objective. Motion picture entertainment can evolve far beyond the inherent limitations of live entertainment.

Reproduction Deficiencies

Before discussing the operation of the Fantasound equipment, some deficiencies of conventional sound-picture reproduction may be summarized:

(*a*) *Limited Volume Range.*—The limited volume range of conventional recordings is reasonably satisfactory for the reproduction of ordinary dialog and incidental music, under average theatre conditions. However, symphonic music and dramatic effects are noticeably impaired by excessive ground-noise and amplitude distortion.

(*b*) *Point-Source of Sound.*—A point-source of sound has certain advantages for monaural dialog reproduction with action confined to the center of the screen, but music and effects suffer from a form of acoustic phase distortion that is absent when the sound comes from a broad source.

(*c*) *Fixed Localization of the Sound-Source at Screen Center.*—The limitations of single-channel dialog have forced the development of a camera and cutting technic built around action at the center of the screen, or more strictly, the center of the conventional high-frequency horn. A three-channel system, allowing localization away from screen center, removes this single-channel limitation, and this increases the flexibility of the sound medium.

(*d*) *Fixed Source of Sound.*—In live entertainment practically all sound-sources are fixed in space. Any movements that occur, do so slowly. It has been found that by artificially causing the source of sound to move rapidly in space the result can be highly dramatic and desirable.

It is felt that Fantasound provides a desirable alternative to the four major deficiencies just described.

There have been other attempts to provide increased volume range and a broad sound-source. It appears that three separate program channels are an essential part of any solution to these sound problems. The matter of maximum usable loudness in the theatre is closely related to the number of separate program channels used.

Three channels sound louder than one channel of three times the power-han-

† J. Soc. Mot. Pict. Eng., August, 1941.

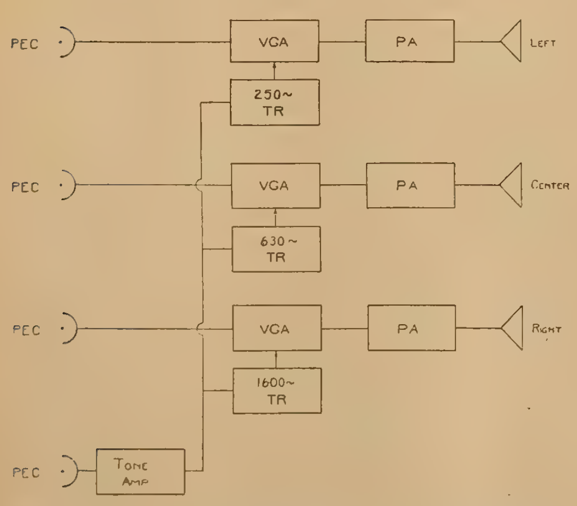


FIG. 1. *Simplified block diagram of Fantasound reproducer*

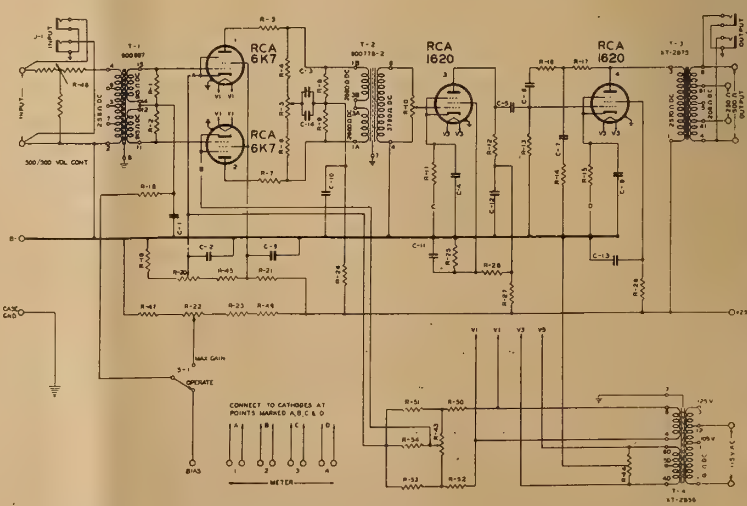


FIG. 2. *Circuit diagram of the variable-gain amplifier*

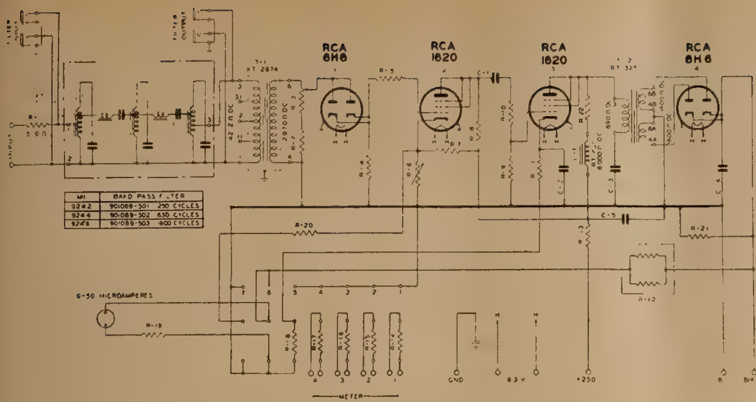


FIGURE 3 *Circuit diagram of the tone rectifier*

dling capacity. In addition, three channels allow more loudness to be used before the sound becomes offensive, because the multiple source and multiple standing-wave pattern prevents sharp peaks of loudness of long duration.

Three tracks and program channels have other advantages over a single-channel system. Cross-modulation between different sounds can be greatly minimized. Dialog, music, and effects could conceivably be placed upon separate tracks. It should be pointed out that single-frequency, steady-state measurements of amplitude distortion do not necessarily give an indication of the amount of cross-modulation that may be present in a single channel. It has been found that low-frequency transients, caused by even-order overtones, can cause objectionable cross-modulation at levels somewhat below the nominal peak overload point of the amplifier.

For economic reasons, it is almost impossible to eliminate this source of cross-modulation from single-channel reproducers. It is a simple matter to isolate conflicting program material on a three-channel system.

The use of three program channels allows phase differentiation to supplement amplitude differentiation in obtaining directional perspective. The phase differentiation also minimizes trouble with acoustic interference in the theatre, which often accompanies attempts to use a multiplicity of horns on a single-program channel.

Differential Junction Network

The first step toward Fantasound occurred when we were asked to make a sound move back and forth across the screen. It was found that by fading between two speakers, located about 20 feet apart, we could simulate a moving sound-source, provided that the total level in the room remained constant. It became obvious at once that simple mechanical ganging of the volume controls feeding the two speaker circuits was not capable of producing the desired effect.

A special two-gang volume-control was then designed with complementary attenuations in the two circuits such that the sum of the attenuations, *expressed as power ratios*, equalled a constant.

Many uses have been found for this type of network. It is extensively used in our Fantasound re-recording system to make possible constant output fades possible. A special 3-circuit differential junction network, nicknamed "The Panpot," is used to dub one original track onto one, any two, or all three of our Fantasound program tracks with smooth transitions and any desired level difference. Thus we simulate a moving sound-source by starting on either side-track and progressively moving the program material through the center-track to the other side-trade.

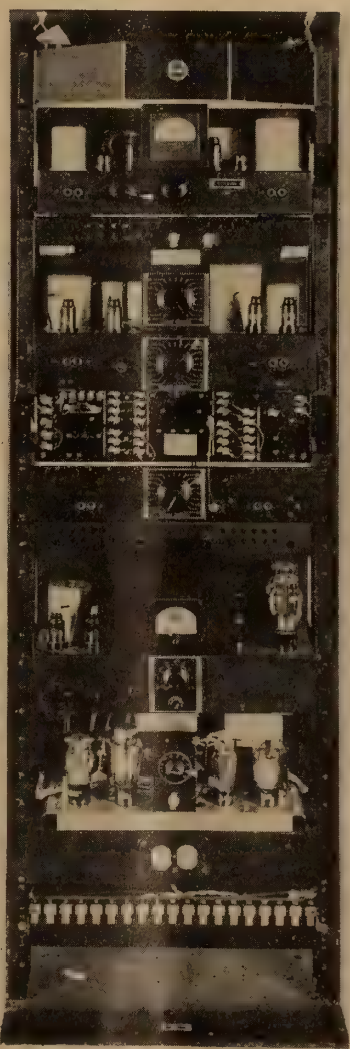


FIG. 4. *Program rack with front cover removed*

This move through three tracks, and thus three horns, is made smoothly by maintaining constant the *total* output of the three tracks and horns, regardless of the distribution among the three program circuits.

The simple 2-circuit differential junction network has been used to make smooth, constant-level fades between two sound-sources. It also has been used to vary the ratio of close to reverberant microphone pick-up without affecting the output level. It was found to be a convenient means of controlling reverberation.

Fantasound Reproducing System

A simplified block diagram of the reproducing equipment is shown in Fig. 1. On the left are shown the four photocells which scan three program tracks and a pilot control-track. Each program photocell feeds a variable-gain amplifier, then, through power amplifiers, the three-stage horns.

Associated with each variable-gain amplifier is a tone rectifier, which selects one of the three pilot tones on the control-track, rectifies it, and applies the resulting D.C. control bias to the grids of the variable-gain stage. Thus the output from each loud speaker varies with the amplitude of its associated control tone.

The heart, or perhaps we should call it the brain, of the Fantasound reproducer is the tone-operated, gain-adjusting device, abbreviated *Togad.*

The *Togad* equipment is composed of two units—the variable-gain amplifier and the tone rectifier. A sine-wave control-tone is applied to the input of the tone rectifier, where it is transformed into a D.C. bias voltage, which is then applied to the variable-gain amplifier to vary its transmission. The equipment is arranged so that a 1-db change in tone level causes a 1-db change in program transmission through the variable-gain amplifier.

Variable-Gain Amplifier.—The variable-gain amplifier, abbreviated, *VGA*, is a single stage of transformer-coupled push-pull pentode voltage amplification (Fig. 2). Its transmission is a function of the D.C. bias applied to its grid circuit. A variation of 5 db in the

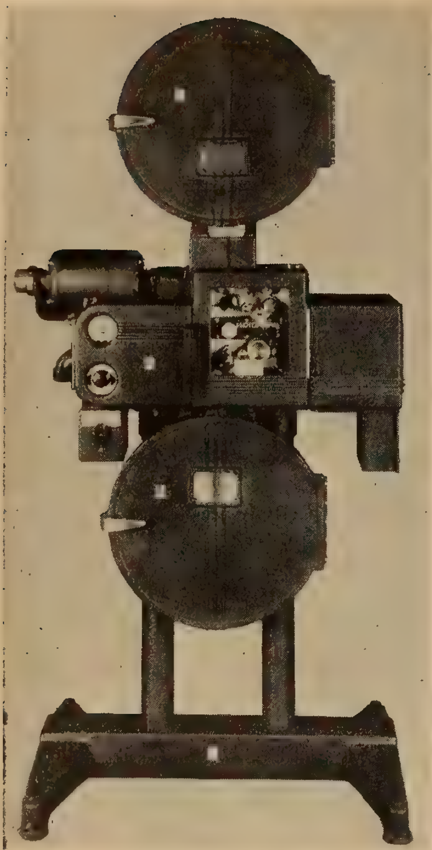


FIG. 5. ***Film-phonograph***

transmission through the *VGA* can be effected by changing the bias.

A two-stage, single-ended voltage amplifier follows the variable-gain stage and the three-stage unit has a maximum gain of 58 db and maximum power output of +6 db above 6 milliwatts.

The circuit features of the variable-gain stage include a balancing potentiometer in the plate circuit to balance out tone cross-talk; a loaded cathode resistor to provide high initial bias and low transmission in the absence of tone; and switches and bias potentiometers to test and adjust the bias-gain characteristic of the 6*K*7 variable-gain stage.

Normally, the maximum level applied to the *VGA* input terminals is about —45/0.006w, although up to about —30/0.006w the distortion is not excessive. Hum and tone cross-talk at this point are well below tube hiss.

The change in tranmission, with bias, is the result of two effects occurring simultaneously. Raising the bias lowers the *mu* of the tubes, thus reducing the ability of the tubes to amplify. Raising the bias also raises the internal plate resistance, which increases the ratio of mismatch between the plate circuits of the tubes and the relatively low load resistance into which the tubes look. The combination of these two effects makes the transmission a complex inverse function of the bias.

It might be noted that screen and bias regulation have a marked effect upon the bias-transmission characteristic. The external control bias, obtained from the tone rectifier, is used to "buck out" a semi-fixed bias obtained from a cathode tap on the plate supply bleeder.

The Tone Rectifier Unit

The tone rectifier (Fig. 3) contains four important elements:

(*a*) A band-pass filter in the input circuit designed to select the proper control tone and reject noise and the unwanted tones.

(*b*) A compressing amplifier, using a 6*H*6 and a 1620 tube. The 6*H*6 half-wave rectifier cuts off the negative half-cycles of tone and the remaining positive half-cycles are applied to the grid of a 1620 triode functioning as a grid current compressor. Contact potential and gas current in both 6*H*6 and 1620 tubes are balanced out by the variable cathode-bias resistor in the 1620.

(*c*) A 1620 triode amplifier, transformer coupled.

(*d*) A 6*H*6 full-wave rectifier, whose D.C. bias output is fed to the variable-gain amplifier.

There are many time-constants in the *VGA* and tone rectifier which contribute to the total "operate" and "restore" time-constants of the combination. However, all but the time-constants associated with the 6*H*6 rectifier ripple filter are so small, relatively, that they may be neglected. The *RC* products of both charge and discharge circuits are approximately equal and the "operate" and "restore" times are about 15 milliseconds.

Figure 4 shows most of the equipment used in one program channel. The topmost panel contains a pilot light. Below that is shown the tone rectifier unit. Next below is the variable-gain amplifier, which has two volume-control knobs in the center. Immediately below the *VGA* is an equalizer panel. Below that is a volume-control panel, and next below is a 20-watt power-amplifier. The lowest shelf contains a regulated plate supply.

In addition to the equipment shown in this rack, a program channel normally includes a single stage of preamplification ahead of the *VGA*, and a 60-watt power-amplifier following the 20-watt amplifier. The front cover, normally used on this rack, is not shown in Fig. 4.

Multi-Track Film-Phonograph

This film-phonograph, shown in Fig. 5, scans four 200-mil, push-pull sound tracks simultaneously on one 35-mm. print. It is driven in synchronism with a picture projector by means of a selsyn interlock system. The lamp and film compartments are shown in Fig. 6.

Film Drive.—The sound-tracks are scanned on a curved film-gate. Constancy of film movement is obtained by the use of a magnetically driven drum which draws the film down over the gate. Flutter measurements indicate that this is a highly satisfactory driving and scanning arrangement.

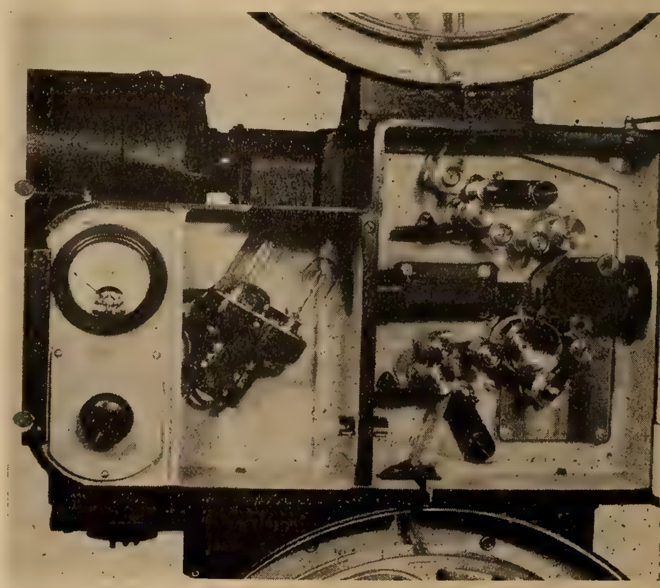
Optical System.—A single 10-volt, 5-ampere exciter lamp mounted in a double holder in the left compartment of the sound-head provides the illumination. All four sound-tracks are scanned simultaneously by a single optical system of the slitless type.

The optical train consists of a light-collecting optical system which images the lamp filament as a long beam of light $1\frac{1}{4}$ mils high across the four sound-tracks. The illuminated image of the sound-tracks is then projected by a camera and cylindrical lens system onto four multiple beam-splitter lenses which, in turn focus each half of the push-pull sound-tracks upon the respective cathodes of four push-pull phototubes.

(To be continued)

FIGURE 6

Showing the lamp and film compartments of the film-photograph



Aids to Peak Performance of Speakers

THE theatre sound system speaker unit is an electric motor and as such is subject to many ordinary motor troubles and a few peculiar to itself, but it is immune to one of the commonest problems of other motors in that it needs no lubrication.

As a motor the speaker unit has parts corresponding to the stator and rotor of common motor construction, but the speaker rotor does not rotate but develops a reciprocal or plunger action. It consists of a small coil of wire, or, sometimes, of aluminum strip which is wound edgewise. It is mounted on a flexible member, the diaphragm, which serves as both a support for the voice coil and as the coupling device through which the power developed by the voice coil is imparted to the object to be moved. That object, in the case of a speaker, is of course air, to which a vibratory motion is imparted.

Test for Raspy Sound

The voice coil moves in a slot prepared for it in the fixed or stator element, but it does not touch the sides of the slot. It is accurately suspended in the slot by carefully correct positioning of the diaphragm. Sometimes the diaphragm, because its work is to vibrate, slips out of adjustment. This will result in the voice coil touching or grazing one side of its slot. The result is, first, raspy sound, and, shortly afterward, ruin of the voice coil. Rubbing against the side of the slot, it rubs off its insulation, or tears loose from the diaphragm to which it is cemented.

Any raspy sound in a speaker unit calls for immediate investigation of the centering of the voice coil in its slot, and re-centering immediately if the diaphragm has slipped. A simple but effective test that can be applied to many types of speaker units is to rest the tips of the fingers gently near the center of the diaphragm, gently exerting and releasing pressure, thus moving the voice coil in and out. If it rubs, that can be felt.

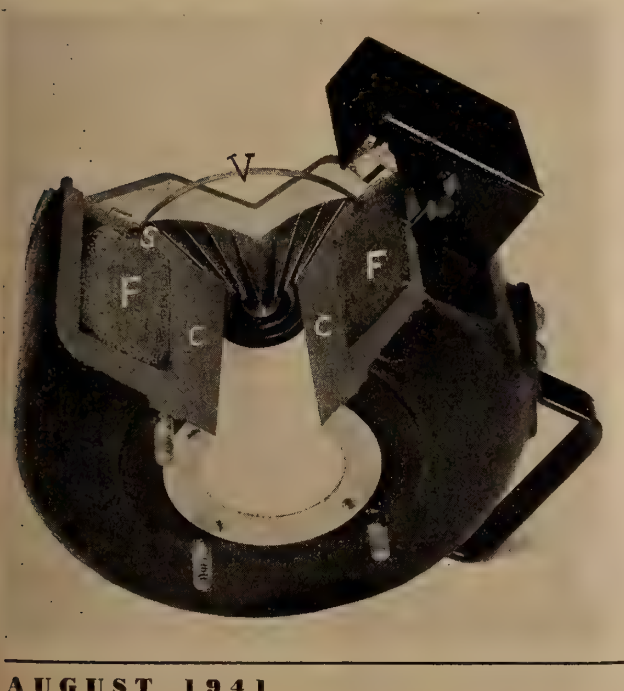
Some units are so constructed that this test cannot be applied; they should be returned to the factory if they produce a rasping sound. It is no economy to keep a raspy unit in service, since the voice coil will almost certainly be destroyed very soon.

Where the construction of the unit is such as to make impossible on-the-spot repair, the coil is re-centered in its slot by re-positioning the diaphragm. The correct position is found by inserting shims between the sides of the slot and the voice coil. The manufacturer of the speaker will advise the thickness of the centering shims to be used for each model. They are usually very thin shims, because the clearance is intentionally made small.

In any ordinary electric motor, where efficiency is desired, clearance between rotor and stator is made so small that it is sometimes hardly possible to insinuate a piece of paper between the two. Similarly, in the loud speaker the slot, which, magnetically-speaking, is a gap in the circuit of magnetic flux, is made, for the sake of efficiency, just wide enough to accommodate the voice coil without excessive risk of rubbing. To reduce the gap width still further, the coil is sometimes built of aluminum strip instead of wire, the strips being wound edge to edge, producing a very thin coil.

The A.C. impedance of the voice coil can be measured very roughly with an ordinary D.C. ohmmeter by the common formula of multiplying the D.C. resistance by 1½. While the result thus obtained will not be wholly accurate, it will with most speaker units serve well enough as a guide for emergency connections until more accurate data can be obtained from the manufacturer.

The stator or motionless unit of the speaker is either an electro-magnet or a permanent magnet. When it is the former, a rough rule is that the wattage of the magnet is approximately equal to the sound wattage the voice coil can carry. Thus, if speaker field utilizes, say, 2 amperes at 10 volts, it is a moderately safe conclusion that the voice coil will be able to handle about 20 watts of sound current.



V is the voice coil, made, in this case, not of wire but of aluminum tape wound edge to edge. S is the slot in which coil vibrates. F-F are the wires of the field coil. The core of this electro-magnet is the casting C-C. The intensity of the magnetic force acting on coil V is increased by keeping slot S as narrow as possible. That is why the voice coil is wound with aluminum tape set edgewise; wire would result in a thicker coil and require a wider slot. The diaphragm is not shown here; it is, of course, cemented to the voice coil in the completed unit.

N. Y. STATE AFL HEAD SLAMS SENATE MOVIE INQUIRY

Thomas J. Lyons, president of the New York State Federation of Labor [A. F. of L.], has issued a statement condemning the Senate sub-committee investigation of the movies as aiming "to intimidate the moving picture industry into curtailing the production of films which truthfully reflect the wretched living conditions in Germany and Nazi-occupied countries."

In the statement given to the Stop Film Censorship Committee, Lyons called upon the nation's trade unions to take immediate action in demanding that the sub-committee be dissolved. The activities of the Wheeler-Nye-Clark inquiry, the statement declared, represented "a serious menace to the very fundamentals of our freedoms and our democracy in an hour of national crisis.

"Our trade unions should take it as their duty to demand that these un-American activities be stopped at once by dissolving the sub-committee," Lyons concluded. His statement coincides with the position of A. F. of L. leaders generally.

W. E. ADVANCES S. BRACKEN

Western Electric Co. has announced the appointment of Stanley Bracken as General Manager of Manufacture, effective October 1. This is a new office in the company, made necessary by the great increase in its manufacturing activities. Mr. Bracken has a record of 29 years service with W. E., having started after graduation from the University of Nebraska in 1912 as a student engineer in the Hawthorne Works.

NOW IT'S A 'DEFECTIVE SPLICE'

A defective film splice started a fire in the projection room of the Andover, Ohio, Theatre. Flames spread from the machine to all parts of the room, damaging equipment and completely destroying two feature films.

Women, Over-Age Men Unsuited For Arduous Projection Room Work

By *C. C. FENNELL*

The use of women and over-age men as replacements for the many professional projectionists who have been called to the colors is a topic that is currently agitating British film exhibition circles. This question, discussed in these pages recently†, is again considered in the appended statement by a prominent operator of a string of British newsreel theatres, as reported in "Kine," a leading English film journal. This exposition is notable in that it is an accurate summary of the worth of projectionists by an exhibitor who does not hesitate to state these truths to his colleagues.

I DO not think that the reference to women, at this stage, is at all helpful. Early reference to the practicability of using women as projectionists has already confused the issue quite sufficiently. I do not believe that the work is suitable for women or that there are many women who would be prepared or equipped to undergo the lengthy training required.

First, there is the prolonged training in technical matters; then there are the physical requirements: many hours of standing, heavy cases of film to handle, and general strain intensified by lack of necessary years of background training. Also, at the present time, these people are not interested in projection; they would rather go into other work of national importance at which they can much sooner achieve a position of responsibility.

There is an impression abroad that little more than a "machine-minder" is required. Nothing is further from the truth. "Machine-minding" and "switch manipulating" is the most easily acquired part of projectionists' job; in fact, it is more often left to the juniors.

A full working knowledge of the mechanism of projectors, knowledge of arcs and optical systems, electrical machinery and wiring, and a fair knowledge of sound reproducing systems is needed.

Extensive Knowledge Required

A projectionist has to know sufficient of the internal parts of his plant to avoid making disastrous mistakes which would cause irreparable damage to the machinery he is operating. He must have the ability of a fitter combined with that of an electrician so that he may maintain his plant. Failing proper maintenance, conditions will arise that will endanger the safety of the public.

The management expects projectionists to detect faults developing in the projectors and to replace parts in need of renewal. Apart from routine service to the plant, such as oiling and cleaning [during the latter operation faults are most likely to be detected] rectifiers, contactors, electrical switchgear and the emergency lighting system must be frequently inspected and serviced.

† "Feminine Film Hands Busy in British Projection Rooms," by Marjory Boulton; I. P. for July, 1941, p. 16.

Then, in view of war conditions, outside service and spares are already becoming more difficult to secure, and the projection plant will age and become more liable to breakdown.

The result of taking 3,000 first and second projectionists would result in the immediate closing down of many theatres, unless suitably skilled men were offered as an alternative. Other theatres might endeavor to carry on with women or young boys acting as junior projectionists (this will happen anyway). With unskilled men acting as projectionists, breakdowns will become increasingly frequent and situations dangerous to the public will arise.

Public Safety Angle

Even in normal times situations arise in well-run projection rooms which might be serious from the point of view of public-safety, and upon the projectionist falls the considerable responsibility of doing the right thing at the right moment.

Fires, of course, are the obvious risk, although panic caused by a badly controlled blaze may be more likely to cause disaster. One or two major theatre disasters would, in their general effect, far outweigh any advantage that would arise by the taking of responsible men under consideration for the armed forces.

I think that full responsibility for the competent staffing of projection rooms should be thrown back to the Home Office. In other words, naturally opposed as I am to internal control, I consider that in the interest of public safety it would be necessary for the Home Office to ensure that projection rooms were competently staffed; otherwise the safety of the public would be endangered and it would be incumbent upon them to order the closing of the theatre.

At the present time local authorities are responsible for the administration of Home Office regulations, and they could not be expected to bear the burden of this responsibility under such conditions.

FREE RCA PHOTOTUBE BOOK

A booklet, entitled "Phototubes," describing in detail phototube theory, construction and operation has been made available free of charge to I. P. readers by RCA. Requests for copies may be addressed to the Commercial Engineering Section, RCA Manufacturing Co., Inc., Harrison, N. J.

INDUSTRY ILLS, NO. 3479

The Essex Theatre, Newark, N. J., in Springfield Ave., offers three full-length features, at a dime early admission charge. Now, as an extra inducement, the house offers each patron a bottle of soda pop gratis.

POTWIN, ACOUSTIC EXPERT, DIES

Charles C. Potwin, nationally-known acoustic consultant for Erpi, died recently of phlebitis following a two-week illness. During his professional career he was responsible for the acoustic design of the Temple of Religion and the A. T. & T. Building at the New York World's Fair, the new Kleinhans Music Hall in Buffalo, the auditorium of the Metropolitan Museum in N. Y. City, and many others. His contributions to architectural design based on acoustic principles have been hailed in leading professional journals as spectacular advances in the science.

In recognition of his contributions, Mr. Potwin was made a fellow of the Acoustical Society of America, serving as the Society's treasurer at the time of his death.

RKO 26-WEEK STATEMENT

RKO Corp. and subsidiary companies yesterday reported a net profit, after all charges, of $485,605.38 for the 26 weeks ended July 5, compared with a profit of $220,819.07 for the corresponding period last year. At the same time, the company announced a net loss of $723,404.89 for the 53 weeks ended July 5.

C. S. Perkins has been appointed district supervisor in the Boston district of Altec Service.

13 Theatre Fires, $135,000 Damage, Iowa's Six-Months', All-Time High Record

Iowa, which rates about the lowest of any State in the matter of effective theatre building regulation, now has rung up the unenviable record of 13 serious theatre fires, representing property damage of $134,723, for the first seven months of this year. Latest theatre fire was the Town Theatre, in Milton, in which a volunteer fireman died of suffocation in an unsuccessful attempt to prevent the complete destruction of the community's only theatre.

This record of theatre fires and accompanying deaths comes as no surprise to the well-informed, because Iowa is notoriously lax in regulating places where motion pictures are shown. As detailed by George Hartnett, secretary of Des Moines Local 286, in I. P. for April, repeated efforts of projection men to gain some slight measure of protection for property and human life have bucked up against the stone wall of an indifferent legislature, which has turned down four consecutive attempts of the craft in this direction.

Progress in Electron Multiplier Tubes

IMPROVEMENTS in electron multiplier tubes, resulting in greater stability of action and simplified manufacture, brings nearer the day when amplifiers may be operated with only a single tube, however much gain is required. In current amplifier types, of course, the possible gain or power that can be obtained from a single tube is limited, and when one tube has done all the amplifying it can, the strengthened signal is passed on to the next tube. Thus amplification proceeds by stages.

The electron multiplier tube makes use of a phenomenon which in ordinary tubes is a disadvantage, that is, the so-called secondary emission. The primary emission, of course, takes place from the surface of the heated filament or cathode. The emitted electrons, being negative, are drawn to the plate of the tube by a positive charge imposed on the plate. Enroute they pass through the meshes of a grid interposed between cathode and plate.

The electron multiplier tube has all these features. The signal to be amplified is connected to the grid. Comparatively slight changes in the grid charge have an enormous effect upon the number of electrons able to pass through the grid meshes, and thus produce very great variations in plate current. This is normal amplification. The electron multiplier uses the same process.

Present Tube Limitations

Limitations to the amplification obtainable by the present process, in any one tube, arise out of several factors. One is secondary emission from the plate. Bombardment of the plate by oncoming electrons occasions an emission of electrons from the plate's surface. Although these electrons, being of course negative, are promptly drawn back again into the positive plate, their continued emission and re-collection by the plate produces a continuing cloud of negative charges around the plate's surface. Electrons approaching the plate from the cathode are to a degree repelled by this cloud of negative charges, which thus offsets the positive charge of the plate itself and limits the amplification of which the tube is capable.

In the common four-element type of tube, a screen grid is introduced between the plate and the control grid. This screen grid, negatively charged, tends to suppress secondary emission, and thus permits greater amplification.

All these principles are used in tubes and amplifiers installed in theatres today and are familiar to thousands of projectionists.

The electron multiplier, instead of suppressing secondary emission, makes use of it to secure further amplification. It does not have a screen grid. In such tubes secondary emission is useful and therefore not discouraged.

Multiplier Tube Construction

The plate is located at an angle to the stream of oncoming electrons. It does not face them squarely, as in other tubes, but faces partly toward the cathode and partly toward another plate located still further from the cathode. The stream of oncoming electrons produces secondary emission which in this case does not return to the plate surface whence it came. A remoter plate, carrying a still stronger positive charge, attracts the plate-emitted electrons, which consequently go on Plate 2. The latter, in turn, faces partly toward Plate 1 and partly toward Plate 3, with the latter being still further removed physically and carrying a still stronger positive charge.

Secondary emission from Plate 2 is attracted to Plate 3, where it produces secondary emission that is attracted to Plate 4, and so on. In every case the secondary emission is stronger than the oncoming emission that caused it, and at the end of the process relatively tremendous currents can be produced, still carrying the wave-shape of the original signal.

The entire process takes place in one tube. That tube, to repeat, consists of cathode, grid and plate, plus a number of secondary plates charged at successively higher positive voltages.

Since the material of which these plates are made is obviously of great importance, extensive research in improving it has been carried forward. Currently announced is a new patent, assigned to RCA, covering the use of magnesium alloys and claiming simplified manufacture and greater stability in the operation of the tube.

Applied to theatre problems, the electron multiplier tube should be able to perform all the amplification necessary between photocell and loud speakers, even in the largest theatres.

S.M.P.E. Fiftieth Anniversary Convention

EVERYTHING is in readiness for the Fiftieth Anniversary Convention of the Society of Motion Picture Engineers scheduled for the Pennsylvania Hotel, N. Y City, October 20-23 inclusive. The tentative program lists a group of papers that will fittingly usher in the twenty-sixth year of the Society's existence.

The Convention will open at 10 a. m. on Monday, October 20, with a general session during which Society business will be conducted, including reports from the Convention Committee, the financial vice-president, and the engineering vice-president. Following an address of welcome by President Emery Huse will be the election of officers and governors for 1942. This session will also feature four papers of more than ordinary interest to motion picture engineers.

The usual informal get-together luncheon, scheduled for 12:30 p. m. in the hotel roof garden, will be presided over by President Huse and will feature addresses by prominent members of the film industry. An afternoon and an evening session will round out the first day, with the latter meeting offering two important papers on television and another on the I. R. system of photography, an optical method for increasing depth of field, by Dr. A. N. Goldsmith.

Projection topics will monopolize both of Tuesday's sessions, including the report of the Theatre Engineering Committee, always a high point of the Convention; a paper on theatre safety devices; a discussion of arc lamp and screen light characteristics, and two papers on projector carbons by engineers of National Carbon Co. No session will be held on Tuesday evening.

Only one session will be held on Wednesday, and that in the morning, the afternoon being left open for recreation and diversion. The 50th semi-annual banquet and dance will be held Wednesday evening in the Georgian Room of the hotel, to be featured by the introduction of officers-elect for 1942, the presentations of the Progress Medal and the Journal Award, and a well-rounded program of entertainment.

A symposium on fine-grain film will

Question: Who Pays For Bicycled Damaged Film?

So acute has become the shortage of prints, particularly in Mid-West exchange centers that bicycling of prints from one theatre to another has become commonplace. Distributors offer no explanation for this unwarranted shortage, and they turn a deaf ear to all complaints anent poor print quality resulting from the continuous use of subjects without even the pretense of inspection.

It would be interesting to observe distributor reaction in the event that one of these prints should take fire in the projector mechanism without having been inspected for tears, etc., between runs. It's a foregone conclusion that the distributor would promptly bill the exhibitor for every foot of film damaged.—J.J.F.

feature the first Thursday session, and will be followed in the afternoon by a meeting devoted to improved technique for sound recording and reproduction.

All members and visitors to the Convention are urgently requested to register at Society headquarters, inasmuch as such receipts go far toward defraying the expenses of the meeting. Special hotel rates are available for visitors to the Convention. Sightseeing trips, golfing privileges, and other diversions may be arranged at Convention headquarters. Registration cards will serve as admission to several *de luxe* theatres.

A specially attractive program for the ladies attending the Convention is being arranged by the Ladies' Committee. A suite will be provided in the Hotel where the ladies will register and meet for the various events upon their program.

The SMPE Convention terminates Thursday, October 23, and on the two following days meetings will be held in the Hotel Pennsylvania by the Acoustical Society of America, the Optical Society of America, and the Society of Rheology.

A number of papers will be presented at these meetings that may be of considerable interest to members of the SMPE, and a joint luncheon of the three organizations will be held at noon on October 24. Delegates from out of town who may wish to remain over for these meetings should make the necessary arrangements for extension of their hotel reservations. Those desiring programs in advance of the meetings may communicate with the American Institute of Physics, 175 Fifth Avenue, New York, N. Y.

The ASA Sectional Committee on Motion Pictures (Z-22) will meet on Wednesday afternoon, October 22, at 1:30 in the Pennsylvania Hotel.

Abstracts of some of the papers scheduled for the Convention are appended hereto:

A PRECISION DIRECT-READING DENSITOMETER

M. H. Sweet

Agfa Ansco Corporation

The history of physical densitometers is briefly discussed. In spite of developments in modern electronic circuits, simple photoelectric instruments suitable for routine sensitometry are not yet in common use. The present densitometer is designed to fill this need. The minimum requirements for a satisfactory instrument are outlined. Photographic density as such, and density standardizations are discussed.

The densitometer density of the present instrument as related to that of other types is demonstrated. The optical aspects, including the geometry and spectral qualities of the system, are explained, and the problem of calibration discussed. Emphasis is placed upon the practical agreement of different optical systems suitably calibrated, and specific examples are shown.

The circuit arrangements of previous photoelectric densitometers are outlined. The theory and practical development of the

(*Continued on page 23*)

Materiels Shortage Worries All Exchanges Anent Cases, Reels

National defense program demands is making it increasingly difficult for film company purchasing departments to obtain needed supplies and materials, including shipping cases and reels, it has been learned.

Situation has resulted in a letter going to all 20th-Fox branches calling for careful handling of cases and reels and requesting that carriers be asked to guard against damage. Letter said in part:

"From now on, there will be a shortage in view of the fact that if we should order 100 shipping cases, we will probably get 20 per cent of that quantity and in due time our stock will be depleted. Therefore, we cannot stress too much the fact that steps must be taken to conserve every shipping reel and case, condition permitting, and as you accumulate a surplus of shipping cases and reels, let us know so that we can transfer them to other branches whose supply may be exhausted."

Vendors of cases and reels have advised 20th-Fox that priority orders makes it compulsory that the Government approve orders before manufacturers can go ahead with them. Defense program demands are said to have sent prices of needed materials skyward, while some cannot be obtained.

Considerable difficulty is being encountered in having orders filled for chemicals, almost all types of metal, book papers in odd lots and electrical appliances. Neither is it possible to match color stocks due to shortage of chlorine.

NEW DETROIT IA SERVICE UNIT MAKES FIELD'S FIRST DEAL

Agreement reached between the new I.A.T.S.E. local in Detroit local covering doormen, ushers, candy girls and cashiers, and representatives of Co-operative Theatres of Michigan, making the first union contract in this field, averted threat of a strike. This effects nearly 200 Detroit theatres, including nearly all except first and second-runs which are being negotiated, as independents have generally agreed to follow the Co-operative agreement.

Scale for usherettes, ushers and candy girls is 32½ cents per hour, with 2½ cents raise in second and also third year, with six-day week of 40 hours and time and one-half for overtime. Doormen and chief of service are five cents above scale. Cashier's scale is not settled yet.

Houses under 1,000 seats are given 2½ cent concession below scale. Houses under 500 seats have 30 cent minimum which will probably be maximum where special consideration is required.

RCA'S SIX-MONTH NET

RCA and subsidiaries for the first six months of the year reported recently a consolidated next profit of $5,306,494 after all taxes and all other charges, a gain of $2,121,272 over the figure for the same period a year ago.

Net profit for the second quarter was $2,571,921.61 as against $1,238,328.32 for the second quarter of 1940. Quarterly net is equal to .127 on the 13,881,016 shares of outstanding common; a year ago, earnings equalled .031.

The profit for the first six months of 1941 is after providing $4,740,000 for Federal income and excess profits taxes, compared with $1,579,900 for the corresponding period in 1940.

HINTS ON ELECTRIC SHOCK

DISABLING electric shocks often act by paralyzing that portion of the brain which controls breathing. In such cases, artificial respiration, as for a drowning person, acts as a restorative. When the path of the current has been such as to paralyze those brain centers that control the heart action, artificial respiration does not restore. However, since only an expert can tell which condition has occurred, artificial respiration should be used and a physician summoned immediately.

The amount of current the human body can tolerate is amazingly low, as little as 1.2 milliamperes at 60 cycles producing the sensation of shock when passed through the arms and body. Circuits carrying such low currents normally do not cause shock only because their voltage normally is insufficient to break down the insulation of dry, oily human skin.

The body tolerates a.c. and high frequencies better than d.c. and low frequencies. At 60 cycles, 5 milliamperes passing through arms and body have been found to occasion shock to the point of serious distress. At 11,000 cycles, however, the average man can tolerate 30 milliamperes through arms and body before his sensations become distressing. At 100,000 cycles nearly one-half ampere is tolerable.

STUDIO NEGOTIATIONS EAST

Negotiations between the studio local unions of the I. A. and the producers will be held in New York, according to word emanating from the Coast, which indicates that international representatives will be the chief negotiators of the new deal. It is expected that the local union memberships will be given an opportunity of passing on any deal that is set.

S.M.P.E. 50TH ANNIVERSARY MEET IN N. Y., OCT. 20-23

(*Continued from page 22*)

present electrical circuit are described, and the effects of the novel features are shown. An accurate linear density scale is obtained in a single-stage D.C. amplifier, and the sensitivity is sufficient to permit the use of a rugged output meter. A density range of 0 to 3.0 is covered, and the characteristics of the output meter are given.

The technics used in prior densitometers in attempting to secure a linear density scale and adequate scale length for good legibility are discussed, and the technic used in the present instrument is compared with them. The performance characteristics of the electrical circuit make it suitable for application to recording instruments.

The routine operation is described and the permanence of calibration is shown. Data are given on the warm-up period and drift, and on the influence of varying line voltage. Operation is entirely by alternating current. Practical performance considerations such as convenience in reading, eye fatigue, *etc.*, are reviewed, and figures showing the comparative speed of operation and reading accuracy are given.

A REVIEW OF THE QUESTION OF 16-MM EMULSION POSITION

Wm. H. Offenhauser, Jr.

Precision Film Laboratories

When a 16-mm sound-film is properly threaded in a 16-mm projector, the emulsion of the film may face the screen (which position is called the "standard" position) or it may face the projector light-source (the "non-standard" emulsion position).

In the case of 35-mm film, the standard position for the emulsion of a print is opposite that for 16-mm; in 35-mm, the emulsion faces the light-source of a projector. The anomaly of the 16-mm emulsion position arose from the fact that a large number of the earliest 16-mm commercial sound-films were made by optical reduction from 35-mm

S.M.P.E. Fiftieth Anniversary Convention at Hotel Pennsylvania, N. Y. City, Oct. 20-23.

negatives. Since the "standard" was established, however, numerous developments have occurred in direct 16-mm production which now practically compel the recognition of so-called "non-standard" prints as a factor of fast-growing importance in our rapidly growing 16-mm industry. The expression "non-standard" emulsion position no longer carries the stigma ordinarily associated with other things that are called non-standard.

Optical Printing of 16-mm. Unlikely

Motion picture films may be printed either by contact (the emulsion of the film to be copied is in physical contact with the raw film upon which the copy is to be made) or by optical printing (the emulsion of the two films are not in physical contact; some form of lens system is interposed between the film to be copied and the raw film upon which the copy is to be made). By far, the largest percentage of picture film printed today is printed by contact methods. It does not seem likely that 16-mm-picture film will be printed optically in the near future for a number of reasons, not the least of which is the lack of available lenses due to the defense program.

The use of Kodachrome duplicates has been growing very rapidly and since contact printing of Kodachrome originals will continue to be used for some time, the "non-standard" emulsion position will continue to be a rapidly growing factor in 16-mm-sound-projection that can not be ignored.

STREAMLINING A SOUND PLANT

Loren L. Ryder

Paramount Pictures, Inc.

This paper discusses the trend in modern sound-recording equipments. It reviews the objectives and requirements that are now existing in regard to studio recording as contrasted to previous recording systems. Several new developments in the art of sound recording are discussed and from this group are selected a complementary series of improvements which together are streamlined into a new recording plant.

SOME EQUIPMENT PROBLEMS OF THE DIRECT 16-MM PRODUCER

L. Thompson

The Calvin Company

The production of industrial films by the direct 16-mm method is now definitely out of the experimental stage.

As more industrial work is done by this method there is an increasing demand for more and better 16-mm equipment suitable for professional use. Such equipment can be developed successfully only after the professional user has found by actual experience what he needs and wants.

MOBILE TELEVISION EQUIPMENT

R. L. Campbell, R. E. Kessler, R. E. Rutherford *and* K. V. Landsberg

Allen B. DuMont Laboratories

While portability is a necessary requirement for outside pick-up equipment, several advantages result when portability is carried into the studio. To equip a studio of adequate size with fixed equipment for operation of several cameras involves considerable time and expenditure. However, with portable studio equipment, the entire equipment installation can be located to suit studio needs, as well as moved to different studios or outside locations.

The dolly type of equipment is described in some detail, and systems for program control are discussed. Some of the design features discussed are portability and flexible synchronizing equipment; electronic viewfinders; oscilloscope monitors; and other operating facilities.

PRODUCTION AND RELEASE APPLICATIONS OF FINE-GRAIN FILMS FOR VARIABLE-DENSITY SOUND RECOVERY

C. R. Daily

Paramount Pictures, Inc.

Fine-grain film materials have supplanted the normal positive type emulsions for all variable-density sound recording and printing operations. The sound-quality improvement realized by the reduction in noise and dis-

tortion is now available for all sound operations, including release prints.

The paper describes a number of problems encountered and solved in the commercial application of such films for sound recording, including factors affecting the choice of negative and print materials, noise, distortion, sensitometric characteristics, recorder lamp supplies, and noise problems on stages.

LABORATORY MODIFICATION AND PROCEDURE IN CONNECTION WITH FINE-GRAIN RELEASE PRINTING

J. R. Wilkinson *and* F. L. Eich

Paramount Pictures, Inc.

While fine-grain emulsions have been in general use for specialty purposes for three years or more, their use as a medium for release prints is comparatively recent. This paper discusses the necessary modifications required in a release print laboratory to produce satisfactory fine-grain release prints. The discussion covers the light-source, power supply, light-testing, and printing equipment. Observations noted while processing the first thirty million feet of release prints are made relative to the behavior and characteristics of the film.

DYNAMIC SCREEN—A SPECULATION

Robert W. Russell

Training Film Production Laboratory

Within its present limits, various phases of the motion picture have been brought close to technical exhaustion and artistic satisfaction. Competition with color television and other forms of entertainment require that motion pictures come forth with another "sudden impact of novelty" similar to its other great discoveries: screen personalities, story, montage, sound, color.

One great frontier remains for film-makers and engineers: the selective delimitation of the screen. The familiar rectangular screen shape forces the motion picture to accomplish everything within a rigid opening like a window. Feeble attempts have been made to vary this arbitrary shape, usually by trying to substitute other arbitrary shapes: the "Grandeur" wide-film, the square frame, the circular "iris-in," camera matte shapes. Unprogressive justification for the present rectangle is in static painter's composition, in commercial standardization, and in a false claim of relationship to the "Golden Section" rectangle.

It is possible to speculate on a new type of motion picture production using the unlimited, unframed "Dynamic Screen," permitting another "sudden impact of novelty" to meet the increasing competition of similar medium of entertainment. Great new fron-

tiers of cinematic effect are opened up by making the screen area the entire proscenium wall, by employing a projector lens that will throw the 35-mm. frame to cover this whole wall as a potential, and by selectively limiting the projected image to smaller pictures within this potential, using peculiarly appropriate or eccentric delimitations in an overall montage of boundaries. Such a production can be imagined, described, and even accomplished with present-day equipment.

A NOTE ON THE PROCESSING OF EASTMAN 1302 FINE-GRAIN RELEASE POSITIVE

V. C. Shaner

Eastman Kodak Company

A brief historical resume is given of a series of fine-grain films that have been put upon the market during the past four years. This series of fine-grain films culminated with the acceptance of Eastman *1302* fine-grain release positive at one Hollywood laboratory to the exclusion of regular positive of the *1301* type for release printing.

Experimental data are presented to show the comparative sensitometric characteristics of fine-grain positive *1302* and regular positive *1301* at various *p*H values and potassium bromide concentrations typical of Hollywood positive developers. A basic positive developer formula derived from chemical analyses of every release positive developer in Hollywood was used in the experimental work. Some practical facts are discussed, based upon the experiences obtained from the initial use of the fine-grain film in Hollywood.

A CONSTANT - TORQUE FRICTION CLUTCH FOR FILM TAKE-UP

William Hotine

The Rotovex Corporation

From the standpoint of film protection, a take-up mechanism should be reliable, wear should not appreciably alter its characteristics, and it should maintain the film tension between safe limits. These objects are attained by driving the take-up spindle through a constant-torque clutch of novel construction and design.

A new type of friction-clutch is described, which, when adjusted initially to deliver a given safe torque to the take-up spindle, maintains this torque at a constant value which can not be exceeded. The clutch construction is simple and rugged, and wear of the friction element does not appreciably affect the operation. Due to the fact that the torque at the take-up spindle is maintained at a constant value, a safe value of film tension is not exceeded. An analysis of the forces and mechanical constants of the clutch mechanism is given, deriving an equation of these in terms of torque delivered.

RECENT DEVELOPMENTS IN PROJECTION MACHINE DESIGN

E. L. Boecking *and* L. W. Davee

Century Projector Corporation

This paper discusses the design features of a new projector to meet the ever-increasing demands for accuracy and simplicity required by modern projection in the theatre. Basic, fundamental, scientific functions of motion picture mechanism design are discussed relative to perfection of film motion, clearer definition, light transmission, and picture steadiness.

As in the design of any scientific mechanical device, the stability and inherent durability must first begin with perfection in the basic design and it must be built upon a foundation of engineering knowledge proved by practical operating experience. In order that these design features may be appreciated it will be the purpose to show how every step of the engineering design, every part of the mechanism, and every motion were carefully planned so that mechanical perfection could be achieved.

Projector Mechanism Design Analyzed

The design and operation of the gear-train are discussed with respect to its simplicity, mechanical accuracy, and long life; the design and operation of the bearings are reviewed in the light of recent developments relating to permanent operation with minimum servicing; and the intermittent movement operation is analyzed in relation to more stable operation and steadier picture reproduction.

The film-gate and film-trap design, providing more uniform film travel at less film tensions, is described as well as methods of obtaining perfect placement of the film plane with respect to the optical axis. Finally, the theoretical design features of single- and double-shutter operation are outlined and the actual operating results expected and realized discussed.

ECONOMIC AND TECHNICAL ANALYSIS OF ARC LAMP AND SCREEN LIGHT CHARACTERISTICS

Henry D. Behr

Many exhibitors do not understand what is meant by the relative inefficiency of power for ultimate consumption at the arc in comparison to power actually delivered at arc. Deficiencies in various parts of the projection plant are described and a value is placed upon losses to emphasize the need for constant attention to details.

Tables are presented showing the excessive carbon and current costs that result when arcs are operated at higher currents due to defects in equipment. Emphasis is placed upon the fact that too many arcs operate at or near the upper limits for which they were designed and too little leeway is left for extra current to increase light for dull prints or color-prints.

Some ideas are given as to what to look for in competitive arc equipments. Various procedures are described for minimizing current and carbon waste due to poor reflector mirrors.

Suggestions of projectionists have too long been ignored by managements. The latter should take a little time from their booking and other problems to ascertain that poor screen light is costly and definitely contributes to drops in attendance.

A FREQUENCY-MODULATED CONTROL TRACK FOR MOVIETONE PRINTS

J. G. Frayne *and* F. P. Herrnfeld

Electric Research Products, Inc.

A 5-mil. frequency-modulated track located between sound and picture areas is proposed to control reproduction in the theatre from one or more sound-tracks. A variation of approximately one octave in the control frequency provides a 30-db change in volume range which may be used in part for volume expansion of loud sounds or as noise reduction for weak sounds.

The control-track frequency is varied manually and recorded simultaneously with the sound-track in the dubbing operation, the gain of the monitoring channel being varied in accordance with the control frequency to produce automatically the enhanced volume range desired from the release print.

How Track Is Recorded

The track is recorded in line with the standard sound-track and does not require separate printing or reproducing apertures. It is scanned by a separate photosensitive surface, the output being converted from frequency to voltage variations by a frequency-discriminating network identical to that used in the monitoring channel. The output from the network, applied to the grid of a variable-gain amplifier in the sound channel, controls automatically the volume of the reproduced sound in accordance with that observed in the dubbing operation.

THE DESIGN AND USE OF FILM NOISE REDUCTION SYSTEMS

R. R. Scoville *and* W. L. Bell

Electrical Research Products, Inc.

Methods of increasing the signal-to-noise ratio in film recording that have been extensively developed in recent years include the following: use of double-width push-pull sound-tracks, pre- and post-equalization, fine-grain film, noise-reduction bias systems, squeeze-track, volume compression and expansion, and control-tracks. The principles underlying the use of such systems are treated, and the manner of combining them to obtain the most effective noise-reduction is shown.

The design of noise-reduction bias systems is explained in considerable detail and the application to a new unit is described. Although this information has largely developed from the variable-density method of recording, much of it is also applicable in the variable-area system.

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Monthly Chat

REPORTS of theatre fires continue to employ a phrase, "invented" several years ago, to the general effect that "the film exploded" in ascribing the cause of the accident. This phrase always induces befuddlement and frustration in this corner, because it relates strictly to *effect* (what happened) and ignores completely *cause* (how it happened).

Now, projectionists handle thousands of feet of film annually, yet it can be said that no film ever "exploded" of and by itself. Before film can "explode" it must have been subjected to an application of heat. We all are familiar with the ease with which film catches fire in the projector when subjected to the heat of the carbon arc. And we are not unmindful of the results of operating carelessness, ranging from the placing of a reel of film on a rheostat to the suicidal tendency displayed by one's smoking while film is exposed in the same room.

The "explosion" of film is an *effect* —either of some defect in equipment or in the film itself—but it certainly is not a *cause*. Which brings us to the point of this statement:

Whenever a theatre fire has its origin in the projection room, representatives of the organized craft in that area should bend every effort to ascertain the *cause* of the accident—whether it be some defect in the print itself or in room equipment, or due to careless operation. It isn't enough to keep a record of film fires; the vital question that cries aloud to be answered is that relative to the *cause* of the fire. Such investigation, if thorough, should unearth data of incalculable worth to both the physical and economic security of the organization.

Physical security, the safety of the men in the projection room, we all understand. But—economic? Yes; because projection room fires tend to minimize the importance and thereby the worth, in terms of wages, of members of the organization, which has nothing to sell but the services, and expert services, of its members.

Such an intelligent outlook backed up by swift action once a projection room fire has occurred will go far toward eliminating such nonsensical explanations as that "the film exploded".

• • •

Reports indicate that there is no great rush on the part of the theatre field to avail itself of coated projection lenses, whether new or a revamp job of present units. Which merely goes to point up the general apathy of the exhibition field to things technical, the while there rises to the sky a strident cry for some "revolutionary contribution" by the industry's technical forces to prop up sagging box-offices.

INTERNATIONAL PROJECTIONIST

VOLUME XVI SEPTEMBER 1941 NUMBER 9

Advance Signs of Reproducer Trouble

II.

SOME forms of sound reproducer trouble give audible warning in advance—occasionally weeks in advance. Some give visible signs, as by changing or unsteady meter readings, flickering signal lamps, *etc.* Very useful as a warning is a raspy, tearing noise in the sound—almost always a sign of sparking somewhere in the system. Continuation of the condition usually ends by rupturing some connection entirely, or burning out some part. That disturbance in the sound is, of course, trouble in itself, but it is also a warning of worse to come. Commonly it is not itself a very serious trouble, occurring perhaps once in a long while and lasting only a few seconds. But it is always a serious warning.

The sparking may be anywhere. Tube sockets and fuse clips are perhaps the commonest but by no means the only locations, which are found by a process of elimination. When sparking is reasonably frequent, or lasts for more than a few seconds at a time, the location can be run down by intelligent switching. If emergency equipment be present, such switching can be done during the show; otherwise it is done before or after showtime.

If the sound is heard more rarely, and doesn't endure too long, elimination proceeds by noting which projector was in operation, and so on, as far as one can go in this direction. With full duplicate equipment the difficulty can in that way be run down to within a very small circle of possibilities. Otherwise, only minute inspection of every socket, checking of fuses to see if any are working warm, tugging of all wires, examination at last of every soldered connection, will turn up the cause.

A somewhat similar warning, representing, however, a raspy distortion of the sound more than a separate noise, is given by a speaker unit in which the voice coil has shifted out of position and is rubbing in its slot. This is almost always noticed that the speaker unit is about to fail, unless the coil is re-centered.

A hum of line frequency that increases in intensity over a period of days or weeks is another sharp warning. It *may* not presage worse trouble, but only nothing more than weakening of a tube which will never wholly burn out, or loosening of the holding bolts of a power transformer. But it may also forecast failure of a tube that will burn out, or a filter condenser that is heading toward a short-circuit. If changing the tubes and tightening the bolts of the power transformer fail to effect drastic improvement, suspect the condensers. Replace them if in doubt—it's cheaper than taking chances; a short-circuited condenser can burn out a lot of other parts, including some that cost much more to replace.

By *LEROY CHADBOURNE*

Visible Trouble Signs

Crackling sounds also are often trouble warnings. Where a rasping sound is likely to indicate a definite if very slight open circuit [a gap however small with current sparking across] a crackling sound is likely to be the result of a make-and-break condition, with full contact one moment and none the next. Obviously the no-contact condition may become permanent at any time, with complete sound outage. Finding the trouble is pretty much the same proposition as finding the source of sparking, except that in this case tube sockets and fuse clips are less likely to be involved, and volume controls usually take first place in the list of suspects.

What is true of a crackling noise is also true of an unsteady signal light, which perhaps accompanies such noise. If it does not, it may not foreshadow real trouble, but only, for example, a

lamp bulb loose in its socket. In any case it is comparatively easy to run down: the circuit connected with that lamp needs investigation, not the entire system.

A fluctuating meter reading may indicate only overloading, to be remedied by reducing volume; but it may also mean weak tubes, particularly if the volume setting is normal. It may or may not accompany crackling sound, in which case it will indicate the circuits to be investigated, and also, depending on circumstances, the urgency of the condition.

A high meter reading is likely to be more serious than a low reading. In most projection room circuits it indicates high line voltage, which condition, if it persists, is the forerunner of a whole calendar of troubles.

Most projectionists know that a sagging filament, particularly in a high-current rectifier tube, indicates weakening of that filament and impending burn-out. The tube may not fail immediately after its filament sags, may last quite a while in fact, but it needs watching and, if possible, should be transferred to a socket where its sudden failure will have the least serious consequences.

Interpreting Trouble Signs

Naturally, many trouble signs need interpretation. For example, to consider a simple case, if the meter of Fig. 1 gave a low plate current reading for all the amplifier tubes, it might be natural to suspect VT-6, the rectifier that supplies them all. But there are other possibilities. No matter how dangerously low the readings might be, before stopping a show to change VT-6 it would plainly be advisable to look at some other meters in the projection room, not associated with this amplifier, to make sure the line voltage isn't at fault. That much is plain to everyone, but it doesn't exhaust the matter.

In an amplifier somewhat similar in general arrangement, which like Fig. 1 supplied current to the exciter lamps, persistently low meter reading was traced to a switch fault that permitted both exciters to be lit at full current at the same time. Here a symptom which was thought to indicate very serious impending trouble turned out to mean only a mild fault already present.

Again, amplifiers generally similar to that of Fig. 1 may not have the switch D-2, which makes individual readings possible, but only a simple meter connected solidly in series with L-2 (lower right of drawing) or some equivalent arrangement. In that case a low reading could indicate fault in either VT-4, VT-5 or VT-6, as well as low line voltage and a number of other conditions. *It would be necessary to find out what the lower meter signified* before even trying to guess whether it constituted any serious warning. But it *might* constitute such warning. It would be unsafe indeed to neglect the symptom until the cause of it had been run down and shown to be relatively harmless, which process might prove childishly simple; for example, one glance at some other meter might show line voltage low enough to account for the condition. Or a long and difficult investigation might turn up a potentially serious short-circuit across terminals 7, 8, 9, G-4 (lower right).

What is important here is (a) that possible trouble signs cannot always be taken at surface value but must be interpreted according to the equipment and the conditions; and (b) they must never be neglected simply because they *may* be harmless. Run them down and find out.

All the trouble signs considered thus far are the product of mild troubles likely to grow serious. But there is another category of signs entirely relating to the *causes* of trouble. Line voltage fault, already mentioned, is an exception to the statement just made, in that this condition rightly belongs in the category of trouble causes.

Among trouble causes is excessive vibration, which effects chiefly the soundhead and apparatus physically connected therewith. This condition may be the product of projector neglect, or of the use of an inadequate base, or even of a weakening of the floor. In any case it is a sure sign of trouble. At best it will jar the exciting light out of alignment, and spoil the quality of sound until adjustments are made. It is likely at any time to create noisy sound, to damage or open the sensitive photo-cell connections, produce flutter—in short create a host of varied difficulties.

Another common trouble symptom is a projector that drips oil into the soundhead. Soiled picture and noisy soundtrack are the most obvious of the troubles to be expected. Impaired insulation in the soundhead, with consequent noisy sound almost impossible to cure short of complete rewiring, is also forecast. Loss of quality and volume through oil-stained optical components is also to be expected.

Serious line voltage faults are also a sure sign of sorrow coming—up to and including complete burning-out of an amplifier. If the power company can't correct the condition, and if the theatre won't install voltage regulators—well, the theatre has been warned. Dirt in many locations is a prediction of trouble; and especially dirt that can get into some types of tube sockets or most types of volume controls. The trouble logically to be expected will

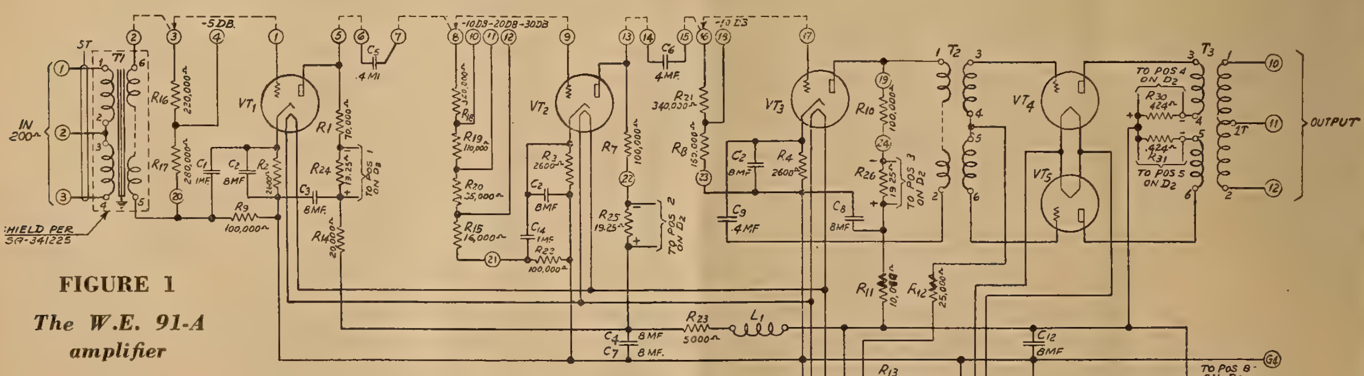
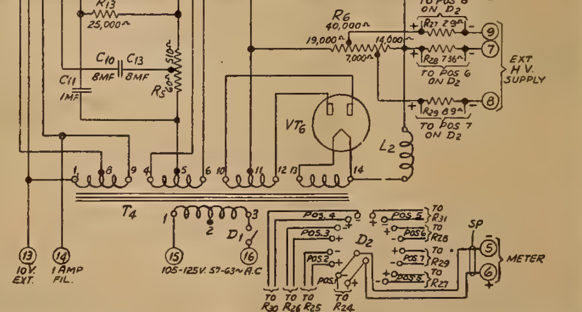



FIGURE 1

The W.E. 91-A amplifier

It must *Sparkle!*

Just as conversation must sparkle to hold interest, so too, must the pictures on your screen today sparkle to hold patrons.

To secure the desired screen brilliancy with present dense black-and-white and colored films, *twice as much light* is required as is possible to project by any low intensity lamp. This necessary doubling in light is possible at an increased combined current and carbon cost of *less than 2c per hour*, with the low cost Strong Utility High-Intensity Projector Arc Lamp.

Without the snow-white light such as is secured by this lamp it is impossible to show colored films satisfactorily. The light of your old low-intensity will appear a dim, muddy yellow by comparison.

Increase your business by installing Strong Utility One-Kilowatt Arc Lamps now. Theatregoers readily recognize good projection and go where it is offered.

FREE DEMONSTRATION

Write your Independent Theatre Supply Dealer today for literature, or have him arrange a demonstration in your theatre without obligation. Strong products for years have been recognized as the most dependable guide to best projection. Complete details will be sent on request by The Strong Electric Corporation, 2501 Lagrange Street, Toledo, Ohio. Export Office: 90 Gold Street, New York City.

range from noisy sound to no sound at all.

A soldered connection that has *too much* solder on it, or one that presents a grainy instead of shiny appearance, may perhaps be a prediction of trouble. (All soldered connections in the entire sound system should be inspected once a year. It is O.K. to do a few at a time, covering the whole system in the course of a year.) Too much solder means there was trouble making the connection, the solder didn't adhere very well, and someone kept adding more and more instead of eliminating the difficulty.

A grainy instead of shiny appearance frequently means that a wire or part was moved while the solder was in the process of cooling. A soldered joint exhibiting either of these conditions should be suspected. Tug and shake the wires or parts involved. Try to spoil the connection by all reasonable means, including a mild application of brute force. If you can do it, the joint isn't good. Re-make it before it breaks down of itself.

The surest of all signs of trouble to come is a failure to watch for trouble signs, to heed or interpret them when they appear, to inspect the system for them periodically or to arrange for such inspection by others. Just let everything alone—pay no attention. This human failing is as sure a symptom of trouble to come as any mechanical or electrical defect.

The RCA 866-A/866 M.-V. Rectifier Tube

ONE of the most welcome advances in tube design and construction is the RCA 866-A/866 half-wave, mercury-vapor rectifier tube that has grown increasingly popular in the sound picture field since it was first introduced early this year. This new tube supersedes types 866-A and 866, and may be used in equipment designed for these former types.

The 866-A/866 combines the ability of the 866-A to withstand high peak inverse voltages with the ability of the 866 to conduct at low plate voltage—at a plus performance beyond any RCA rectifier type ever offered. Thus, at the maximum peak inverse voltage rating of 10,000 volts and a maximum peak plate current rating of 1 ampere per tube, two 866-A/866's operating in a full-wave rectifier circuit are capable of delivering to the input of a choke-input type filter a rectified voltage of 3180 volts at 500 milliamperes with good regulation and exceptional life.

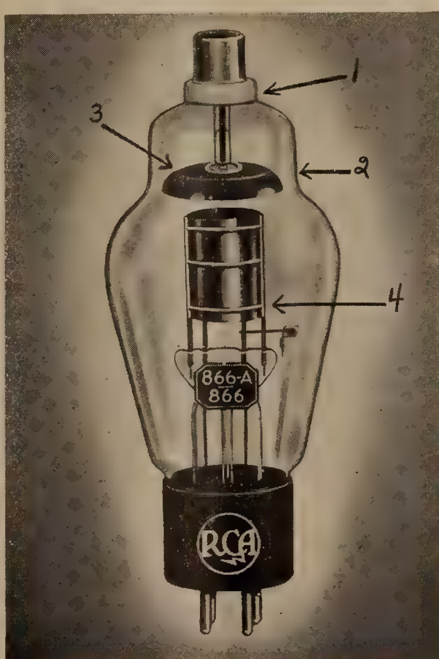
Improved Filament Design

Secret of the 866-A/866 is its improved edgewise-wound coated ribbon filament which is helical in shape and crimped. This design has great mechanical strength and provides more cathode area for the same filament power rating. And above all, the filament is made of a new alloy material that, in combination with the active surface coating, possesses great electron-emitting capabilities and has improved life characteristics head and shoulders above ordinary 866 and 866-A types.

The filament of the 866-A/866 is contained within a shield which permits more efficient utilization of filament heating energy, thus allowing more filament area for a given number of watts. The shield enables the tube to start on much lower voltage than with the former 866-A.

Parallel Hook-up Ups Power

Important among the features of the new RCA-866-A/866 is its new dome type bulb with its added mechanical strength feature, and the large external ceramic insulator positioned under the plate cap. This construction greatly minimizes corona discharge emanating from the edge of the metal cap, which



STRUCTURE OF RCA 866-A/866

(1) Ceramic Insulator to minimize corona discharge (2) dome bulb and (3) low-hanging anode to minimize ionization in upper section of bulb (4) shielded filament construction.

New edgewise-wound coated ribbon filament for RCA 866-A/866 tube. New alloy used improves performance and lengthens life.

in turn alleviates the danger of bulb cracks caused by electrolysis of the glass.

Two or more 866-A/866's can be connected in parallel to give correspondingly increased output current over that obtainable with a single tube. A stabilizing resistor of 50 to 100 ohms should be connected in series with each plate lead in order that each tube will carry an equal share of the load.

The value of the resistor will depend on the value of the plate current that passes through the rectifier. Low plate current requires a high value; high plate current, a low value.

When the plates of 866-A/866's (or for that matter any other mercury-vapor rectifier) are connected in parallel, the corresponding filament leads should be similarly connected. Otherwise, the tube voltage drops may be considerably unbalanced and larger stabilizing resistors will be required.

Additional detailed technical information on 866-A/866's may be had by addressing the Commercial Engineering Section, RCA Manufacturing Co., Inc., Harrison, N. J.

Seeley is 6th Altec Man in Defense Research Work

E. S. Seeley, development engineer for Altec Service has been granted a leave of absence to take up scientific research activities in submarine detection with the National Defense Laboratories, in association with U. S. Navy scientists at Fort Trumbull, New London, Conn. Seeley invented and developed many of the electrical devices by which sound engineers detect the presence of incipient dislocations in motion picture sound mechanisms. Most recent of Seeley's inventions is the direct-reading reverberation meter, introduced at the recent S.M.P.E. Rochester meeting.

Seeley is the sixth Altec engineer who has been requisitioned for research activities in connection with national defense.

CHICAGO L. U. 110 WAGE BOOST

Chicago projectionist Local 110 of the I. A. has negotiated a new wage contract calling for an increase of 5%. First demand of the Local was for a 10% wage boost plus two-week vacations with pay.

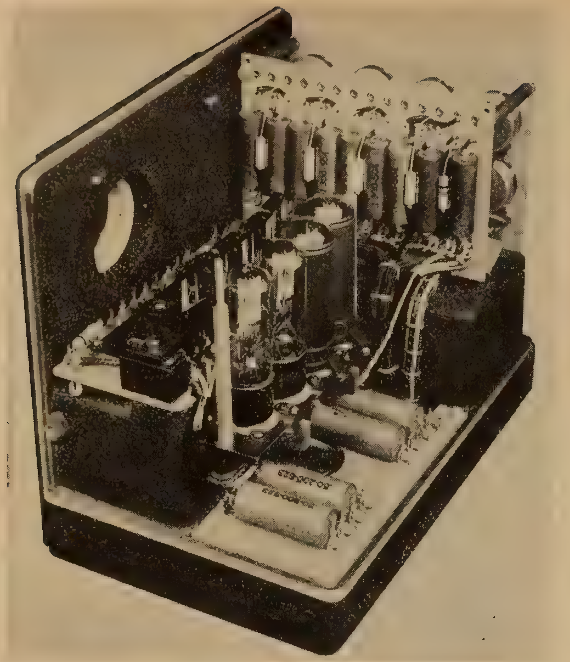


FIG. 7. *Phototube compartment of film-phonograph.*

FIG. 8. *View of the eight recording channels, as set up with attending personnel, at the Philadelphia Academy of Music.*

'Fantasound': a Technologic Epoch†

II.

By *WILLIAM E. GARITY and J. N. A. HAWKINS*

MEMBERS, TECHNICAL STAFF, WALT DISNEY PRODUCTIONS

FANTASOUND reproduction differs markedly in both results and equipment from standard theatre reproduction. It may be of interest to follow the history of the development step by step.

A great many equipment combinations were explored on paper, *probably several hundred!* Of these, ten different systems have been built up and tried out, up to the time this article was written. Even though *Fantasia* has been released, development has not stopped.

The *Mark I* system used three widely separated horns across the stage and horns in each rear corner of the house. Two tracks were used, one feeding the screen horn, or center-stage horn, while the other fed the remaining four horns selectively by means of a four-circuit differential junction network. By manipulating a manual control, the sound could be moved smoothly around the theatre. Experiments with this system brought out the advantages of a broad sound-source.

The *Mark II* system was a simple expansion of the *Mark I* system, adding three horns: one on each side-wall about halfway back from the stage, and one in the ceiling at about the center of the house. These were in addition to the screen horn and four corner horns used in the *Mark I* system. This system used three tracks and a 6-circuit, manually-controlled differential junction network.

In addition to creating the effect of moving the sound *around* the theatre, the controls allowed side to side movements in any plane between the screen and rear wall of the house. Simultaneous fore and aft control was also available.

Up to this time it was felt that the *Fantasia* roadshow equipment could be manually operated by a mixer who would go along with each show. He would provide manual volume range expansion as well as control the perspective effects. However, two objections to manual operation appeared. The five controls became rather complex for one-man operation, and the studio felt that it would be difficult to keep all shows alike, due to the large human element involved.

'Togad' Control Introduced

The use of a pilot tone-control arrangement was suggested to avoid these difficulties, and the *Mark III* system came into existence to study the advantages and difficulties of a pilot tone-control track. This *Mark III* system was a single-channel *Togad* expander, controlled by either an oscillator or a tone track. Problems of cross-talk balance, tone-program amplitude characteristic, time-constants, distortion and noise compromise, and amount of range expansion desirable, *etc.*, were attacked.

The *Mark IV* system was identical with the 8-horn, 3-track *Mark II* system, except that *Togad* control replaced manual control. This system used 8 control-tones on the control track logarithmically spaced from 250 to 6300 cycles, using a preferred number series. This *Mark IV* system was installed in our Hyperion studios in the summer of 1939 and was used for sound and music department research until we moved to Burbank in 1940.

The equipment racks and sound-heads for this system required a floor space about 35 feet long by 4 feet wide. It used nearly 400 vacuum-tubes. All equipment appeared on jacks and almost any conceivable combination could be patched up in a few minutes.

The *Mark V* system, first installed at Burbank, was similar to the *Mark IV* system in that 8 horns, 3 program tracks, and an 8-tone control-track were used. However, by using 8 hybrid coils in the program circuits we obtained a still more

† J. Soc. Mot. Pict. Eng., August, 1941.

flexible system. This system was in operation only one day. The equipment operated satisfactorily and no technical difficulties were encountered. The system failed only because the musical director, the music cutter, and the "enhancing mixer" could no longer remember from one rehearsal to the next, "What should come out where?"

From this extreme of complication, the pendulum swung to the *Mark VI* system, which used 3 stage horns, 3 program tracks, and a 3-tone control-track.

Our first serious dubbing of *Fantasia* was attempted on this system. Our original Fantasound dubbing set-up required 10 program mixers, each with 3 pots, designated "Left, Center, and Right" positional controls. In addition, 3 mixers with one pot each were used to handle the left, center, and right pilot tones.

We soon found that the tremendous number of positional mixing cues made it nearly impossible for a mixer to handle 3 positional controls in such a way as to avoid undesirable discontinuities during moves. We then designed some differentially ganged 3-circuit pots, based on the differential junction network principle, which greatly simplified the mixing problem. This change allowed 6 mixers to satisfactorily control 24 program circuits.

The *Mark VII* was the first of the RCA-manufactured systems. Functionally, it closely resembled the *Mark VI* system. The only important difference lay in the use of a linear tone rectifier in place of the log-log rectifier used in our earlier systems. This changed the tone-program amplitude characteristic.

First Theatre Installation

The *Mark VIII* system consisted of the *Mark VII* equipment rearranged physically. An ingenious log-log tone rectifier, designed by RCA, replaced the linear tone rectifier used in the *Mark VII* set-up. The second dubbing of *Fantasia* was done through this system. After adding a stand-by channel, this equipment was installed in the Broadway Theatre, N. Y. City, for *Fantasia's* world premiere.

FIG. 9. ***View of some of the mixer positions at the Philadelphia Academy of Music.***

The *Mark IX* equipment closely resembled the *Mark VIII* system. The physical layout was again modified, a few minor changes were made, and two sets of rear-house horns were manually switched in to supplement or replace the left and right screen horns at several points in the picture. This system operated in eight of the roadshows.

Scoring and Dubbing

The *Mark X* system is identical with the *Mark IX* equipment, except that the switching and level changes in the rear horn circuits are done automatically instead of manually. The control arrangement uses a thyratron and mechanical relay system operated by means of notches on the edge of the film. This ingenious arrangement was developed by Messrs. Hisserich and Tickner of our engineering department. The *Mark X* system is installed at the Carthay Circle Theatre, Los Angeles.

All the numbers, except *The Sorcerer's Apprentice* and the vocal portions of *Ave Maria*, were scored at the Philadelphia Academy of Music. Eight push-pull variable-area recording channels were used (Fig. 8).

Separate channels recorded close pick-ups of violins, cellos and basses, violas, brass, woodwinds, and tympani. The seventh channel recorded a mixture of the first six channels, while the eighth channel recorded a distant pick-up of the entire orchestra. The mixer handling the distant pick-up used horn monitoring, while the other mixers used headphone monitoring. Cathode-ray oscilloscopes were utilized as level indicators (Fig. 9).

The Sorcerer's Apprentice number was done in Hollywood on a somewhat similar multi-channel system. The *Ave Maria* vocal numbers were recorded on three channels: two close channels, separating male and female voices, with a distant overall channel for added reverberation.

Checking Range Compression

The necessity for checking the range compression on all channels during scoring and dubbing caused the development of a means whereby one man could visually monitor three oscilloscopes. By using color differentiation at the overload and underload points, eye fatigue was minimized. This was accomplished by masks on the face of the cathode-ray tube.

An opaque mask eliminated everything below about 3 per cent modulation, including the complete negative, or downward, half-cycles. A translucent red mask covered the range from 3 to 100 per cent modulation on the positive half-cycles. Above 100 per cent modulation, the trace on the tube was not masked, and so was highly visible. Program material below 3 per cent modulation (100 per cent — 30 db) produced no visible indication. Material between 3 and 100 per cent modulation appeared as a white series of half-cycles, and modulation in

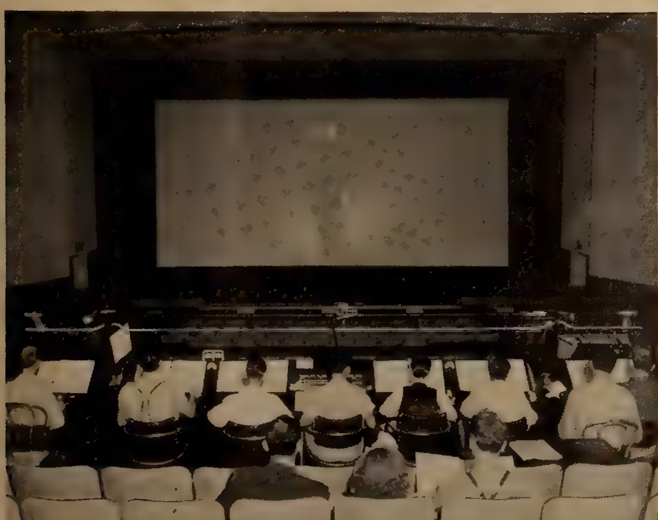


FIG. 10. ***View of the program dubbing console in operation.***

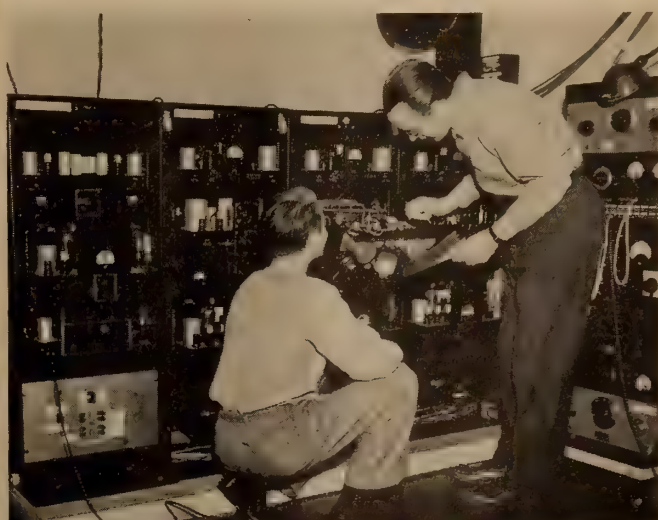


FIG. 11. ***View of part of the dubbing monitoring equipment.***

excess of 100 per cent appeared as a brilliant green series of peaks.

The recording, re-recording, and monitoring systems were poled so that the compression wave, referred to the original microphone, gave positive peaks on both oscilloscopes and galvanometers. This adaptation of the oscilloscope was devised by C. O. Slyfield. Over half a million feet of sound negative was exposed on our scoring channels on this picture.

Our re-recording process used 8 to 10 tracks, depending upon the sequence. Fig. 10 shows the re-recording console in operation. The output of the mixing panels fed three recorders, one for each horn channel, left, center, and right. Another channel recorded the tone track. These four re-recorded negatives were then printed on the composite quad print. The *Mark VIII* Fantasound reproducer was used for dubbing monitoring (Fig. 11). Including everything but release prints, about *five million feet of film was used for this picture!*

This history of Fantasound is far from complete. Another year and we shall know a great deal more about theatre operating and maintenance problems on this type of equipment. To date, our operating and maintenance experience has been quite satisfactory.

We wish to express our appreciation to Walt Disney, whose vision and willingness to encourage technical development made this system possible.

Modern Mobile Theatres Serve the USO

ONE of the most interesting developments in mobile theatre design are the "Automovie" units now being utilized as part of the USO program for providing recreational opportunities for men in the armed forces of the U. S. Conceived, built and equipped by the Jam Handy Organization, of Detroit, these units have been credited with playing a vital role in the establishment and maintenance of morale among the men in training.

The units consist essentially of a special bus chassis with the center section of the roof so constructed as to rise vertically by means of a rack-and-pinion arrangement, driven by an electric motor. On the sides and at the front roller curtains are provided so that when the top is raised this area is enclosed. On the rear of the truck a translucent screen is hinged to the roof and swings down into position when needed.

Inside the truck, facing toward the front, is a Simplex JH type 35 mm. projector, on which is mounted a Strong low-intensity lamp. The picture is projected onto a large mirror mounted at the front of the truck, and is then reflected out through the translucent screen at the rear.

Dual sound channels are provided for sound-picture projection, and when street broadcasting is done, both of the systems can be used simultaneously, one speaker being mounted on the roof and one speaker on each side. A phonograph turntable and microphone are provided near the projector, and this set-up is duplicated near the driver's seat. The rear of the truck is arranged to open up and form a platform for live-talent entertainment and various announcements.

Delco Power Plant Used

Power for the unit is derived from a 2500-watt, 115-volt D. C. Delco power plant which is built into the truck. This power plant is driven by a four-cylinder gasoline engine and is enclosed in an asbestos-lined, soundproofed and electrically-shielded compartment. A rotary converter is utilized to supply A. C. for the amplifier and the turntables. The units are in charge of I.A.T.S.E. projectionists who have been specially trained by Jam Handy.

The entire unit weighs approximately 11,000 pounds and is capable of travelling at from 45 to 50 miles an hour. More than 160,000 men have attended the first 106 performances given with these units, the reports on which have been uniformly enthusiastic to date.

General view from rear towards truck, showing how screen is viewed. No carpeting, aisle lights, ushers or lounge—but what an appreciative audience!

N. Y. 25-30 CLUB HONORS McGUIRE

More than 200 members and friends attended the annual dinner-dance of the 25-30 Club of New York City. The membership of this club consists of men who have been projectionists at least 25 years, and a number have seen 35 to 40 years service.

Mike Berkowitz, President of the 25-30 Club, presented gold cards to the three honorary members of the organization: James D. Lynette, Supervising Chief Inspector, Department of Water Supply, Gas & Electricity, New York City; Bart Green, Chief Inspector, Borough of Manhattan; and P. A. McGuire, Advertising Manager of International Projector Corp.

DeVRY ON SMPE HONOR ROLL

The name of the late Herman A. DeVry, of Chicago, will be perpetuated by the Society of Motion Picture Engineers, in line with the unanimous decision of the membership at the recent Society Convention in N. Y. to add his name to the Honor Roll. DeVry is being honored as a pioneer motion picture equipment inventor and manufacturer, having been responsible for many basic patents that benefitted the entire industry, including the first portable projector.

DeVry's name will be the tenth to be so honored by the Society, the fifth American, and the first Chicagoan.

NICK, WESTON APPEAL DENIED

The U. S. Circuit Court of Appeals in St. Louis has denied the application of John P. Nick, former first vice-president of the I.A.T.S.E. and Clyde A. Weston, former business manager of St. Louis projectionist Local 143, for a rehearing in their appeal from their conviction on a charge of violating the Federal anti-racketeering act. They each face prison terms of five years and must also pay fines of $10,000 each. The Court of Appeals affirmed the convictions in the Federal District Court.

Counsel for Nick and Weston have announced they will petition the U. S. Supreme Court for a writ of certiorari to review the action of the Court of Appeals in affirming the convictions and now refusing to grant hearings.

OWENS TO RCA HOME OFFICE

Jim Owens, RCA Photophone salesman from the Baltimore territory, has been transferred to the home office of RCA at Camden. In his new capacity Owens specializes in theatre screen sales. Prior to his entry into the sales field more than eight years ago, Owens was for four years an RCA Photophone field engineer.

Theatre Television: Some Technical and Economic Aspects

By *ALLEN HYNE*

MEMBER, RCA PHOTOPHONE FIELD SERVICE STAFF

MEMBER, I.A. LOCAL UNION 162, SAN FRANCISCO

Practically all of the comment on theatre television to date has emanated from the laboratory workers or the promotion personnel of equipment manufacturers. That is why the appended article by Allen Hyne, who has had extensive experience not alone in the laboratory but also on the theatre firing line, should be of especial interest to practical projectionists everywhere. The basis for this article was an address delivered by Mr. Hyne before the recent convention of the California State Theatrical Federation, one of the most unique organizations in show business in that the representatives of its 30,000 members deal with the Labor aspects of strictly theatrical matters.

THINGS happen so fast in the industry of which we are a part that the things that seemed impossible yesterday are commonplace today. Overnight new types of screen entertainment start cycles of box office successes which indicate the importance of change, whether it be in our everyday life, the forms of entertainment which theatre audiences prefer, or new developments in equipment which scientific research and development make possible.

For example, $30,000 was the price the late M. E. Commeford unhesitatingly paid for his first motion picture sound equipment. A number of people in his own organization did not agree with his decision to buy sound. His judgment, along with that of other leaders, of course, has been fully vindicated. Today better sound equipment can be purchased for $2,500, or less than 10% of the original cost figure. Only a few years prior to 1928-29, Thomas Edison stated: "The public will not take to talking pictures." Many "Yes"-men agreed with him; others recognized this change and profited accordingly.

Television, like the theatre itself, is not a new idea. It is centuries old. For hundreds of years man has wished to be able to see through space, the same as he wished to fly. It is only as a potentially great factor in the theatre of the future that television is new.

Television, unlike many other fields of scientific endeavor, was conceived long before it could possibly be accomplished. Although the practical solutions of television have been attained gradually, the basic methods of producing sight at a distance were deliberately sought out by inventors, some of whom arrived at solutions for the problems long before means existed for carrying out their ideas. Some of the fundamentals of television were proposed by Blackwell in 1847, when he suggested the "copying telegraph" using a scanning method; and scanning is one of the principles of modern television.

Another example is the Nipkow disc, a fundamental method of scanning, which was patented in 1884, long before apparatus was ready for using it. The idea of using a cathode ray tube for reproducing an image was suggested in 1907, before vacuum tube amplifiers had been invented to operate it. That proposal, in a measure, could be compared with suggesting the construction of an automobile engine before a source of power, such as gasoline, was developed to run the motor. The cathode ray tube, suggested in 1907 by the distinguished Russian scientist, Rosing, is the heart of today's television system.

Incidentally, it was one of Rosing's pupils, Dr. V. Zworykin, director of RCA Electronic Laboratories, who was largely instrumental in the development of the cathode ray system of television that is recognized as the standard not only in the United States but in Europe as well.

Through the years from 1847 down to the present, there have been countless unsung engineers and scientists each of whom has tried to solve the extremely difficult problem of sending pictures through the air. The number who have labored on this problem is in itself evidence of the value they attached to its solution.

In 1924, Dr. Zworykin demonstrated the first crude television picture using the all-electronic system, employing the first Iconoscope or "television eye" to pick up, and the cathode ray tube or Kinescope to reproduce, the picture on the other end. Thereafter the development of television moved forward at an accelerated pace. Dr. Zworykin had developed a system of television without moving parts which held great promise for the future. From then on it became a question of perfecting and refining the system. Not that this was an easy task, for another 14 years of constant study, research and experiments by a large research staff and the expenditure of millions of dollars was necessary to bring television to its present state.

RCA's First Transmitter

In 1928 RCA set up its first television transmitting station. In 1931 the location of this station was changed to atop the Empire State Building, its present site. In 1932 television transmission of 120 lines was used and, incidentally, the pictures from the Empire State Building were relayed to Camden *via* a radio relay link. In 1933 the RCA system was still further perfected and a transmission of 240 lines was used. The following year the definition of the picture was still further improved when the system was changed over to 343 lines; and in 1937 the RMA standard of 441 lines was adopted. Since that time the industry has agreed on 508 lines as a new standard.

In 1935 it was decided that television should be taken out of the laboratory and given a thorough field test, with a view to proving its practicability for home use. We had seen laboratory demonstrations that were entirely satisfactory. But the question was: Will it stand up in the home? Sure, our engineers know how to operate a television receiver; but what about Joe Doakes and Mamie O'Rourke?

To answer this question RCA spent $2,000,000 in a three-year television field test conducted in the New York area. 100 television receivers were placed in the homes of RCA and NBC engineers and executives, and a regular schedule

of television programs was begun. Friends of these engineers and executives were invited in to see the pictures and to operate the receivers. The receivers were not allowed to stay in one spot. They were moved around within an area of approximately 40 miles radius from the transmitter. Out of that field test came a practical television receiver that is no more difficult to operate, and not much more difficult to service, than an ordinary radio receiver.

During that same period RCA engineers also developed a mobile transmitter to be used in picking up outside events, such as tennis matches, baseball games, prize fights, *etc.* The pictures are relayed from this mobile transmitter to the main transmitter atop the Empire State Building. There they are picked up and re-transmitted over the powerful RCA-NBC television transmitter. We refer to this outside pickup device as a mobile transmitter, that is, if you can refer to two 10-ton trucks loaded with equipment as being mobile. Incidentally, the cost of this mobile-transmitter was $150,000. Since this transmitter was introduced RCA engineers have built and made available a portable transmitter weighing only 300 lbs. for outdoor pickups.

Hand-in-hand with the development of home television and the background of research and experience it provided went progress on "big-screen" television. On January 16, 1930, at RKO-Proctors-58th St. Theatre screen the first 8- x 10-foot televised picture was shown to an invited audience of executives, engineers and scientists. This picture was from the studio of the then experimental television station W2XBS, at 411 Fifth Avenue, New York, commercially known as Station WNBT, America's pioneer television station.

On May 7, 1940, at the annual meeting of the RCA stockholders held in New York, another demonstration of large-screen television was held. Again on January 24, 1941, before the Federal Communications Commission, the National Television Standards Committee, and a limited though distinguished and critical audience, at the New Yorker Theatre, RCA presented the first American public exhibition of theatre television on a 15- x 20-foot screen.

Representative Press Comments

The Motion Picture Herald of February 1, 1941, commented as follows: "The program presented for the FCC was arranged to show some of the entertainment possibilities of large-screen theatre television. . . .

"To show the use of theatre television for news coverage, scenes at Camp Upton were shown, having been carried the 68 miles from the army post to New York by radio relay. The cloudy, snowy weather marred this part of the program, but an indication of what can be done to cover topical events was given. The concluding part of the program was a play, 'K-7.' Most of the action took part in studio sets, with motion pictures used for airplane sequences. 'Multisonic sound, similar in effect to the Fantasound used with Disney's 'Fantasia,' heightened the illusion of reality in the final air attack scene. More lifelike sound than usual in pictures partly compensated for the fact that the images lack motion picture brightness.

"The demonstration of large-screen television brings closer the day when certain theatres in key cities will be using special television programs, such as a talk by the President, or an outstanding sporting event, as 'added' attractions."

On the evening prior to this demonstration in New York, Mr. Barney Balaban, at a dinner celebrating his fifth anniversary as President of Paramount Pictures, spoke of the potential value of television in building up theatre attendance.

James J. Finn, editor of INTERNATIONAL PROJECTIONIST, in an extensive article said: "The writer cannot conceive of any motion picture man witnessing this demonstration without being assailed by grave doubts as to the probable effect of television on the cinematic art, which is to say, on the entertainment preferences of the masses. . . . It must be seen to be appreciated."

Therefore in view of the splendid reception accorded this demonstration it was decided to present on May 9, 1941, a demonstration of theatre television for the motion picture industry.

With the enthusiastic cooperation of Madison Square Garden's President, Col. J. R. Kilpatrick, and N.B.C., a varied program was presented at the New Yorker Theatre, which included Lowell Thomas, James A. Farley, a studio stage show, Pathe News scoops from Europe's civilian battlefields, a round table of leading figures in the world of theatre, business and sport, and the 15-round Soose-Overlin championship fight direct from Madison Square Garden by balanced telephone line to the New Yorker audience.

'Acceptable To The Customers'

Motion Picture Herald, said: "Television in the theatre, transmitted by wire—*not broadcast,* has had its demonstration to the amusement trade and the public with large technical success, in extraordinary circumstances—in the face of a world at war, and in the face of special conditions, political and economic within America. . . . It sums up to the fact that large-screen television, good enough for the customers, has been attained."

W. G. Van Schmus, Managing Director of Radio City Music Hall, after commenting on the drawing power of athletic events, said: "Call it whatever name you like, anything that will enable a theatre to *show things as they happen* and so take advantage of the suspense factor of interest, certainly should find its place in the theatre field."

Thus television passed another milestone as a new art for the benefit of the theatre and its patrons. What the theatre industry does about it again brings to the fore the constant change heretofore mentioned and the effect of it on the course of industry.

In the fall of 1938 RCA decided as a result of past successful demonstrations to enter the field of manufacture of television transmitters, associated equipment and television receivers, with an anticipated heavy demand for home receivers to come as a result of the 1940 N. Y. World's Fair and the San Francisco Golden Gate Exposition. This was a momentous decision, since RCA could not afford to risk its standing as the leading research engineering and manufacturing organization in the radio and allied fields, unless there was a deep-seated belief that the time was ripe to move forward.

Behind this decision was not only RCA's own experience in the laboratory and in the field but also the experience

(*Continued on page* 21)

RCA Adds B-L Rectifiers to Equipment Line

Continuing the expansion of its theatre equipment department, RCA has taken over both the domestic and foreign distribution of B-L motion picture projection rectifiers, which are manufactured by the Benwood-Linze Co. of St. Louis. Distribution will continue through independent theatre supply dealers, with sales efforts to be augmented by the work of RCA's field sales and service staffs.

The RCA theatre equipment lineup now includes, in addition to Photophone sound reproducers, the Brenkert lamps and projectors, the Magic Screen, B-L rectifiers, and lens-coating service. It is expected that RCA will make further exclusive distribution contracts in the near future.

Highlights of The S.M.P.E. Convention

SOME of the more important aspects of the technical papers program of the recent 25th Anniversary Convention of the Society of Motion Picture Engineers, together with news of the annual awards and the election of officers are included in the appended summary.

Four officers of the Society whose terms expire at the end of the year were reelected. They are D. E. Hyndman, engineering vice-president; A. S. Dickinson, financial vice-president; P. J. Larson, secretary, and G. Friedl, Jr., treasurer. Dr. Alfred N. Goldsmith, former president and a member of the Board of Governors was elected chairman of the Atlantic Coast Section.

Glenn L. Dimmick, sound engineer at RCA Laboratories, received the Progress Medal of the Society in recognition of his outstanding contributions to the advancement of the motion picture art. The SMPE *Journal* Award was won jointly by J. G. Frayne and V. Pagliarulo, of ERPI, Hollywood. The winning technical discussion, printed in the June, 1940, issue, is entitled, "The Effects of Ultraviolet Light on Variable-Density Recording and Printing."

The Society's honor-bestowing also included the presentation of a certificate of testimonial to William C. Kunzmann, of the National Carbon Co., long-time convention vice-president.

A New 'Dynamic' Screen

A glimpse into the future was afforded by Robert Russell, of Fort Monmouth, N. J., in a paper on the "dynamic screen" for theatres, which he characterized as being the last unexplored horizon of the industry. The dynamic screen is different from the ordinary movie screen in that it may be made to cover the entire front wall of the theatre, instead of being confined to a given area, as at present.

The audience may see the projected film as a pin-point or as a vast panorama. He said that trains may be shown in true perspective across the front of the theatre, while vertical objects may be projected with life-like reality up the front wall. He illustrated by describing how Alice in Wonderland would look on a dynamic screen.

"Alice would be reduced to a mite," he said. "She looks upward and sees the table. She finds the bottle and she drinks the potent liquid. Now she begins to grow, rising across the screen until she truly is enormous, when her head bumps on the ceiling. The element of realism would be injected to a startling degree."

'I.R.' System of Photography

Dr. Alfred N. Goldsmith, noted inventor, described his new "increased range" (I.R.) system of motion picture photography. He explained how his development permits actors to move about freely on a movie set without fear of moving out of camera focus, pointing out that the system removes the limitations of fixed focus which characterize every lens, substituting a virtually unlimited range.

"The human eye has this increased range," Dr. Goldsmith explained. "That's why in a theatre we can follow the actors all over the stage, from the footlights to the backdrop, without having them move out of the focal range of our eyes. The motion picture has been limited in this respect since its earliest days, for directors have been forced to keep their actors within the narrow focal range of the camera. Much has been lost in creating the illusion of true, flowing motion. Instead, we have had to substitute a succession of glimpses of the action."

Dr. Goldsmith's system automatically compensates for the fixed focus of the camera lens by lighting first the foreground, then the middle distance, and then the background of each scene each time a single exposure of the film is made. At the same time, the camera focus is kept in step with the lighting by means of a series of compensating plates revolving behind the lens. Thus, whichever part of the set is being photographed is in perfect focus.

"The action of the system is so rapid that the illumination may be divided into four or even more areas if necessary, although in many cases only two areas may be required," the inventor said. "For each complete single exposure of the moving film, the entire set has been lighted by stages, as it were."

He pointed out that with the new system actors would be freed from the present necessity of keeping within carefully marked bounds on the set, while directors would be spared the time-wasting work of meticulously measuring distances for every scene. Not only will actors be given new freedom of expression, but sets and scenes may be built with greater realism and true dimension.

New Realism in Movie Sound

A new type of reflector which, when installed in a motion picture sound recorder, permits more accurate monitoring of the sound being recorded and therefore contributes substantially to improved sound reproduction in the theatre, was described by Glenn L. Dimmick, of the RCA Laboratories.

He explained that scientists have long known that certain crystals transmit light of one color and reflect light of another color. Some thin metallic films also exhibit the same phenomena. By evaporating alternate layers of different types of film on glass, it is possible to produce a surface having pre-determined transmission and reflection characteristics, while absorbing no appreciable amount of light.

When this new reflector is employed in sound recorders, nearly all the light is transmitted to the sound film for recording, while certain portions of the light spectrum are reflected to a photocell for monitoring purposes. With a more accurate means of determining exactly what sound is being recorded at the instant it takes its place on the sound track, the sound engineers are better able to record exactly the quality, volume and tone of sound which they want. Better pictures result.

Color Television Progress

Improvement in the already realistic images which are being flashed through the air by television has been achieved by the introduction of color into television, according to Dr. Peter C. Goldmark, chief television engineer of Columbia Broadcasting System. Dr. Goldmark said that color television images show small objects to be more easily

Copies of I. P. Needed

The following copies of INTERNATIONAL PROJECTIONIST are urgently needed to complete the file in the library of a large research organization: January to June, inclusive, October and November, all published in 1940. Anyone having any or all of these copies to spare may forward them direct to I. P.; and any expense incurred thereby will be promptly refunded.

perceptible than in black-and-white images, that outlines in general seem to be more clearly defined, and that a certain perception of depth is introduced.

Dr. Goldmark said that initial experimentation with color television showed such possibilities that extensive investigation into that field has been undertaken with the objective of producing a practical color television system. He revealed that on June 1 of this year CBS inaugurated daily color television transmissions in field-testing the new development. The three primary colors employed are red, blue and green. He went on to describe in technical detail how the system was perfected and revealed many of its operating principles.

New Fine-Grain Film

Motion picture audiences are now enjoying clearer, more contrasting films and hearing more realistic sound because of the recent introduction of a new type of fine-grain film. V. C. Shaner, of Eastman Kodak, Hollywood, outlined the benefits of this new type film, recently introduced for general use of the industry after several years of application to special needs of the art. He pointed out that motion picture film is made up of clumps of silver in a chemical solution, and that the finer the grains of silver the better the picture and the clearer the sound.

"It's something like the screening method used to make newspaper and magazine pictures," he explained. "The finer the dots which go to make up the picture on the paper, the clearer the picture. With motion picture film, the silver grains become the dots, so that the finer the grains, the sharper the picture."

Mr. Shaner revealed that the new type film has been adopted by the Paramount studios to the exclusion of older types, and that 50,000,000 feet have been consumed in release print manufacture. Meanwhile, research looking to the production of still finer grained film is already underway, he said.

At the session on motion picture sound developments, two discussions were devoted to recent improvement in control tracks to control the reproduction of sound in theatres. Sound may thus be controlled in volume automatically, adding appreciably to the realism and entertainment value of movies. Such a control track made possible the RCA Fantasound system used in the Disney-Stokowski production "Fantasia."

Patron Seating Preferences

J. G. Frayne and F. P. Hernfeld, of ERPI, Hollywood, told the engineers how control tracks are now available on standard film, being located between the picture and the sound tract. No special processing is required during recording, and the system is fully automatic in operation in the theatre.

A careful study is being made of public preference for seats in the average motion picture theatre as an aid to improvement in the entertainment value and comfort of the American movie. Preliminary results of one such study already made in a typical New York theatre were revealed in the report of the Theatre Engineering Committee read by Dr. A. N. Goldsmith, Chairman. Additional surveys are to be made.

Dr. Goldsmith told them something they already knew—that early birds prefer central theatre seats. But they were shown graphs which revealed in what order each seat was occupied, and they also saw how that whole sections of the theatre were occupied by latecomers only after the more desirable seats were taken. The survey is being made by Society experts in order to determine what seating arrangement is best from the audience standpoint, with a number of different size and different shape theatres being surveyed to assure a complete report.

The report stated that 11 checkers were used in the survey of the first theatre, the "Surrey" in the Bronx. The checkers entered at 6:30 p.m. and stayed until 9 o'clock, with each man assigned a portion of the auditorium to watch. As each person entered the theatre, it was carefully noted where he sat.

They discovered that the most popular area of the theatre was that section *not less* than 4 times the width of the screen from the front, *nor more* than 8 times the width of the screen from the front. The front seats were taken last, being occupied only after the side seats located at a sharp angle from the screen.

The Committee is preparing to make recommendations to the Society for the ideal theatre layout, taking into consideration the location of aisles and the auditorium entrance as well. And unsuspecting patrons are helping decide how they shall be more comfortable and see the picture better.

PRIORITY ON THEATRE EQUIPMENT SOUGHT BY DEALERS

An appeal that OPM grant priorities on vital theatre equipment has been directed to the Government by the Theatre Equipment Dealers Protective Association, through Ray Colvin, its executive secretary. The request is predicated on the grounds that film theatres are a vital factor in building up and preserving public morale in times of national emergency.

The letter points out that the Federal government has recognized the morale value of motion pictures as entertainment by constructing at great cost many theatres in Army camps and posts.

Colvin also takes the position that the manufacturers of various articles of theatre equipment should not be placed in the same classification as to priorities as manufacturers who produce so-called gadgets of a non-essential type or luxury items.

The association has also written to manufacturers of various articles of theatre equipment and also to a large number of independent motion picture theatre owners enlisting their support in the effort to obtain necessary priorities for theatre equipment and supplies.

Hollywood's Trouble is (of all Things) Hollywood

PEOPLE aren't going to the movies these days—at least not as often as the movie producers thought they were before Dr. Gallup came out with his recent poll on movie attendance. And Gilbert Seldes, *Esquire's* well-known movie critic, is worried, according to an article in the current issue. He has heard the wailing of the neighborhood theatre owners; he has read the exhibitors' sour answers to the hoopla of the press agents; he has looked into the figures of bowling alleys, ice carnivals, basketball and radio listening. And he begins to think that the Gallup Poll on movie attendance may be as grim as it looks.

For the Poll was a shock to Hollywood. The ballyhoo always said that 80 million people paid a billion dollar gross at the box office every year. Actually some 55 million, not 80, go—and pay 700 million dollars—a lot, but short of the billion figure. The movies lost their hold, says Seldes in *Esquire*, by producing too many indifferent pictures just when radio and sport were crashing the entertainment field. Sport is Hollywood's worst enemy because it has always been a winner with the men; but recently sports like bowling have been keeping even the women away from the movies.

But Seldes, long noted as a friend of the movies, comes forward with five practical suggestions and one super-colossal, sure-fire way to restore Hollywood to her former glory. Here they are:

The Seldes Success Formula

First [and most important], give the people what the radio stations give them on the air: economically-produced entertainment different in style and material from the great commercial programs—the movie equivalent of sustaining programs. "Just what these may be," says Seldes, "I am willing to discuss with any producer who understands in advance that I am not referring to grade B pictures."

Second, let a few more people discover what makes the movies move—and let those people produce and direct pictures.

Third, shoot one-third of the "writers" in Hollywood; or failing that, "shoot" only two-thirds of the dialogue written.

Fourth, discover what people *really* want in the movies and satisfy these wants as intelligently as possible.

Fifth, widen the area of interest, get away from the formulas which limit and get into the formulas which allow unlimited appeal to the imagination.

Sixth, get new people — which means people who know the movies as spectators and can adapt their technical knowledge of the theatre or radio to the movies.

Daily Press Re-Invents Stereoscopic Movies

THREE-DIMENSIONAL motion pictures have once more been "discovered" by the enterprising gentlemen of the daily newspapers, the basis for which startling finding this time being a paper delivered several months ago by Edwin H. Land, of the Polaroid Corp., Cambridge, Mass., before the Optical Society of America. Building up the yarn, the newspaper boys inserted a statement that the development is a "closely guarded secret" of the "utmost military importance".

Now, the Land development is about as secret as the location of Times Square in N. Y. City. Not only have the basic principles of the process been well known in scientific circles for some years, but the development was discussed at length in the Land paper, which was subsequently printed in an issue of the *Journal* of the Optical Society now several months old.

This is not to imply that three-dimensional movies are impossible of accomplishment. There is the method followed heretofore of using a camera having two lenses which impinge upon two films images corresponding to left-hand and right-hand eye views. These films are then shown by means of two projectors, the images being projected either in pairs or in rapid succession. Special polaroid glasses, "analyzers", are then used by the viewer to get the effect of three-dimensional pictures.

Three-dimensional motion pictures are also attainable by means of the technique employed by Loucks & Norling, of N. Y. City, in making the M-G-M Audioscopics, which were shown in many theatres. Here only a single standard projector is employed, but polaroid glasses still must be worn by the viewer in order to get a stereoscopic effect.

'Analyzers' a Major Problem

Flicker is a major problem to producers of three-dimensional films. One means of minimizing the unpleasant effects of such flicker is to use a double-length film and run the projector at double speed—a procedure which hardly satisfies the normal operating requirements of most theatres.

But the greatest obstacle to general acceptance of three-dimensional films is the enforced use of "analyzers", that is, the polaroid glasses which must be used to convey an impression of depth to the onlooker. Apart from the nuisance attached to their use, these glasses occasion a terrific loss of light in the order of about 50% of the total. Nor does this take into account the light loss encountered at the projector. Moreover, these glasses have a pronounced influence on color, as is well known to anybody who has worn the conventional polaroid glasses intended for normal outdoor use.

The use of these "analyzers" poses an especially difficult problem for proponents of three-dimensional motion pictures. They must choose either one of two courses: first, either a cheap glass which by its very nature will give unsatisfactory results, or second, a good quality glass to be fitted to each patron. In either event it is desirable that all glasses be sterlized after each using. The problem is further complicated by the requirements of those patrons who already wear glasses.

Serious Problems Unsolved

The Land development mentioned in the daily press must be regarded as only a step in the right direction toward three-dimensional motion pictures, not as a solution of all problems incident thereto. Land's own paper discloses that his contribution consists of a means for making a positive film which has different crystals in a single layer, and which is exposed and developed in a special way. This is somewhat removed from the "invention" of a satisfactory means for taking and showing three-dimensional motion pictures.

FIGHT 'JACK RABBIT' SHOWS

Leo Wolcott, president of the Allied-Independent theatre owners of Iowa-Nebraska, has requested exhibitors notify any and all 16 mm. free, five cents, 10 cents or cut-rate shows and portable circuits and give full details of location, pictures and prices.

Wolcott pointed out that rigid control of rentals of 16 mm. by the distributors is needed and that "jack rabbit" operators should receive the same treatment as exhibitors. "They should pay the same proportioned share of the receipts for films as the legitimate theatre owner," Wolcott declared.

RCA NET PROFIT SOARS

RCA and subsidiaries have reported a consolidated net profit of $7,370,165.37 for the first nine months of the year after taxes and all other charges. Earnings compare with $5,209,043.65 for the nine months to Sept. 30 a year ago, or a gain of $2.-161,121.72. Total gross income from all sources amounted to $115,891,712.77.

Anent These Mono-Molecular Layers

MONO-MOLECULAR layers — well, that's just a term which in practice means a layer of some substance at its ultimate theoretical thinness. So what? Well, right now it happens to mean a lot to practical projection.

All substances are composed of molecules. Molecules are composed of atoms, and atoms contain electrons; what electrons may be made of nobody knows as yet. But the point here is that no substance can be divided beyond its molecules. Break up the molecules into their component atoms, and you have a different substance. For any given material, therefore, the molecule is the ultimate division; and if that material be spread out in a layer one molecule thick, there's no known way to get the material any thinner than that.

All this has a very direct bearing on practical projection, which is more thoroughly based on abstract science than almost any other practical art that can be named.

Almost half a century ago certain English photographers found with surprise that *sometimes* a dirty or tarnished lens was more efficient than a clean one! It was usually the other way around, and of course should be. But strangely enough, there were occasions when tarnish on a lens enabled the lens to transmit more, instead of less, light. This odd effect was duly recorded in the technical literature, but nobody did anything about it.

Apparently Contradictory Result

The result seemed to be created by layers of tarnish of just the right thinness. In every other case a soiled lens lost efficiency—as it should. And there was no way anyone knew of to create layers of tarnish of just the right thinness—far too thin for any micrometer to measure, or come even remotely close to measuring. A haze, a dullness, an impalpable fuzz on a lens, utterly beyond hope of measurement, occasionally produced a strange and contradictory result.

In due course photography became motion picture photography; and long after that sound pictures came in. Photo-cells appeared. Projectionists remember the earliest photo-cells used in the theatre. The "active lining" was a coating of light-sensitive material on the inner side of the glass. Later the cell was modified to the type used today: the active material was not placed

on the glass but was "sputtered" onto the curved plate of inert metal which forms the cathode of all modern cells.

Then it was found that the cell would increase in efficiency if the active layer were made thinner. Finally the active layer was reduced to the ultimate theoretical thinness—a mono-molecular layer—and that produced the maximum efficiency in photo-cells. Means were found to create mono-molecular layers in mass production.

It is not so difficult to produce a mono-molecular layer in some practical applications. A drop of oil placed on a surface of water or watery material will not remain a drop of oil. The oil will spread as thinly as it can over the entire surface of the water and produce a scum so thin in proportion to the size of a wave-length of light that the light will be reflected in a rainbow of different colors. Use little enough oil and a large enough surface of water, and the oil will spread and spread until it has attained a mono-molecular layer beyond which it can't spread, but must break up into drifting patches of oil.

Result: the Coated Lens

Although this is not the method of obtaining mono-molecular layers in photo-cell manufacture, it does serve as an example of the basic idea of a mono-molecular layer. Practical manufacturing processes are more complicated but produce essentially the same result. And such processes were first worked out for quantity production of the ordinary theatre photo-electric cell.

Later, these processes and related procedures, including a variation of the old oil-on-water technique, were worked out for investigations in pure science, where they will produce astonishing practical results one of these days.

Of immediate importance to projectionists is one of the first of those practical results—the coated projection lens. Here the old observation of the English photographers confers routine benefits in the modern theatre. Mono-molecular or nearly mono-molecular layers can now be produced on lenses at will. And such lenses are more efficient, just as the old-timers found when dirt or tarnish produced the result by accident. Such lenses transmit more light, reflect less from their surfaces. All glass surfaces involve a light loss by reflection of roughly 8 *per cent per surface.*

With a lens artificially and intentionally "tarnished" by a transparent mono-molecular, or nearly so, coating, that formerly inevitable reflection loss is cut approximately in half. And today's projection lenses can be so coated, accurately and scientifically, as a matter of routine.

MURDER—BY YELLOW LIGHT

Postmen carrying mail to America's theatres recently must have gained the impression that a vendetta was in progress among exhibitors. All theatres equipped with low-intensity projection arc lamps received a "blood-stained" dagger to which was attached a tag with the inscription, "Are You Guilty of Murder by Yellow Light?"

The dagger (rubber), which had been dipped in red lacquer, was mailed as part of the advertising promotion by National Theatre Supply Co. for Simplex High projection arc lamps. The "murder" referred to was that of fine pictures which are projected by the dim, yellow light of low-intensity lamps.

ALTEC ADVANCES PETERSON

In line with its promotion-from-the-ranks policy, Altec Service has moved D. A. Peterson, formerly supervisor in the Philadelphia district, to a branch managership in the same district, under E. O. Wilschke.

Erpi Merged With W.E.; New Export Division Created

Electrical Research Products, Inc., has been merged into its parent company, Western Electric Co. and its domestic activities hereafter will be carried on as the ERPI Division of the Western Electric Co. T. K. Stevenson, former president of ERPI, becomes vice-president of W.E., continuing in charge of this activity. In addition, he will have direction of the general accounting, treasurer's and secretary's departments of the parent company, and has also been elected a director of W.E.

The ownership of the foreign subsidiaries of ERPI has been transferred to a new company to be known as the Western Electric Export Corp., of which Mr. Stevenson will be president. Operating head of the new company will be E. S. Gregg, whose title will be Vice-President and General Foreign Manager. Mr. Gregg has been identified with the foreign activities of ERPI since the company's formation in 1927, and for the last several years has held the title of General Foreign Manager.

Despite the dislocation of foreign trade and import restrictions in several countries, the Company's foreign business has shown a marked expansion, theatre owners cut off from European sources of supply having turned to American manufacturers for equipment.

ERPI was originally set up in 1926 to handle W.E. activities outside of the telephone industry, and it has principally been devoted to the development of the application of sound to motion pictures, in which it has been an important factor. The change in corporate set-up does not involve any change in the character or method of conducting this business; but for some time it has been felt that these activities could be carried on more satisfactorily through the establishment of the closest possible relationship with the parent company, W.E. As a first step in this direction, ERPI's offices in 1937 were consolidated with those of W.E. at 195 Broadway, N. Y. City.

In addition to Mr. Stevenson, present officers of ERPI will continue their responsibilities in the new division of Western Electric.

Tube Industry's Problems Are Cited by RCA Manager

The tube industry's problems will be more serious not only because of limitations imposed by materials shortages, but even more so by the industry's lack of adequate production facilities and trained personnel, according to a statement by L. W. Teegarden, Manager of RCA's Tube Division. To date, he added, all of the government's defense requirements for *receiving* tubes have been met promptly by RCA. These requirements have represented only 6% of the company's total production. At the current production rate, 12% to 15% of total receiving tube production is devoted to defense requirements, and, in Mr. Teegarden's opinion, this percentage will inevitably increase.

Power and special purpose tubes, however, present a totally different picture, he said. Tremendous demands for these tubes, on which the industry has had little or no experience, are being imposed on the industry by the defense program. RCA has responded by greatly increasing production during the past year. The company is building 357% more power tubes, 147% more cathode-ray tubes and 256% more special purpose tubes than a year ago.

Five-Fold Production Rise

In these categories shipments during October were 71% for defense purposes, with every indication that the percentage required for this purpose will increase substantially in the near future. Based on present available estimates, demand in 1942 will be five to six times the value of RCA's 1941 shipments, which are already 2½ times the 1940 total.

Enormous problems remain to be surmounted in the future, Mr. Teegarden indicated, adding that no one in the industry is in a position to predict accurately the available supplies of any types in the coming months. He said that slackening of commercial demand for receiving tubes is probable in the future in view of indications of further government curtailment of radio receiving set output.

REPUBLIC-RCA LICENSE PACT

A 10-year film recording license agreement negotiated in 1938 between Republic Productions, Inc., and RCA Photophone, has been revised to provide for a substan-

tial expansion of Republic's film recording facilities, and also has been extended for an additional ten years. The superceding contract runs until 1951.

Two additional custom-built mobile film recording units and a custom-built acetate disc recording channel will be provided by RCA for handling Republic's steadily increasing production schedule. The film recording machines will utilize RCA's most advanced type of variable area track, known technically as Class B push-pull, with ultra violet light. These tracks, claimed to possess marked advantages in freedom from distortion and background noise, will be re-recorded to standard variable area records for release purposes.

DROLL CARBON CO. BOOKLET

Projectionists and theatre managers will be interested in a new piece of illustrated literature prepared by the Droll Theatre Supply Co., Chicago, on Droll Processed Carbons. This folder, which describes in detail all the efficiencies which are possible with these processed carbons, will be sent to any reader of I. P. on request.

RCA-COMERFORD IN INCLUSIVE SERVICE DEAL FOR 79 HOUSES

In another major service deal completed recently, RCA has closed with Comerford-Publix Theatres Corp. and affiliated companies for comprehensive service to 79 theatres of the Comerford groups. The pact includes furnishing parts and other items to both sound and visual projection equipment. Negotiations were handled for RCA by Dan Halpin, W. L. Jones, and John Bethell, with Charles A. Ryan representing Comerford.

Theatres included in the service contract are located in forty-one cities and towns in Eastern Pennsylvania and Southern N. Y. State.

RCA FLORIDA SERVICE DEAL

Agreements have been signed providing for RCA sound service and furnishing of parts and tubes to the 100 theatres comprising Florida State Theatres, Inc. The contract marks the beginning of the fourth consecutive year of RCA service to this major theatre group.

HOXIE, TALKIE PIONEER, DEAD

Charles A. Hoxie, 74, inventor of the Hoxie sound-recording machine, died recently at his home in Alplaus, N. Y., where he had been living since his retirement in 1932 from General Electric Co.

The engineer's first work with G.E. dealt with measurements in the field of establishing standards of capacity, inductance, resistance, and electromotive force. During World War I he developed a machine designed to speed up U. S. wireless communications. Later this machine recorded wireless dots and dashes on a paper tape at rates up to 600 words a minute, or 30 times faster than the human ear can receive them.

Using the principle employed in that early apparatus, Mr. Hoxie experimented until he had perfected a machine called a "Pallophotophone," which would record sound and film for motion pictures simultaneously.

The inventor's first sound-picture equipment consisted of two machines, a recorder and a reproducer. A light beam was focused on a mirror the size of a pinhead, which was vibrated by sound waves from a microphone. A film track 1/10 inch wide received the beam which vibrated in accordance with the tones of speech and music. These in turn were reproduced. The sound track passed in front of a photocell mounted on the side of a motion picture projector. Film recording which was given its first public showing in Schenectady, N. Y. in February, 1927, gradually superseded the use of disks synchronized with film.

Theatre Television: Some Technical & Economic Aspects

(Continued from page 16)

of the British Broadcasting Co. The system of television used in England is identical to the RCA system, for it is based on an interchange of patents. As a result of this decision and subsequent progress RCA was able to present large-screen television to the theatre industry as well as television for the home.

There has been some criticism by exhibitors and producers that with theatre television in the background the motion picture industry might have cause for alarm anent undue disturbance of current operations. The

optimism of leaders in the business might be summed up in the remarks of George Skouras, who said: "My opinion is that theatre television has reached the stage of being box-office entertainment. The expense of the program is of no importance if the proper product supply is available."

Further, if there was to be any negative effect of television on the theatre industry RCA and its affiliates supplying Photophone sound equipment to the theatres, and doing a major amount of Hollywood studio recording, would itself be affected to a great degree. Certainly it will take a long time even at the estimated price of $30,000 per equipment for RCA to gain the return of the millions it has already spent to make theatre television possible.

Suppose, therefore, that, granting that theatre television is all ready a technical success, we look ahead and see what the future of this new form of entertainment may mean to you and to me. First, however, we might look behind the scenes and answer a few comments, questions and negative reactions of those whose incomes, depend on the theatre, including the motion picture industry, as at present constituted.

Principal Negative Reactions

Here are a few of the remarks we have heard, which, though not representative of the majority, nevertheless merit analysis and reply.

"At $30-to-$40,000 the equipment costs too much for all except a few large houses."

"As a newsreel type fill-in on a movie program it would be worth about present newsreel film costs to the theatre."

"By virtue of it being interstate it may bring the movie industry under government control."

"Hollywood can do better than that which television is attempting, therefore, the movie industry has nothing to be concerned about in theatre television."

"Program material of sufficient quality and calibre is not available."

"Promoters of events drawing large

UNIQUE TRAINING PRODUCTION

"Operation of a Reconnaissance Patrol at Night", new war training film recently put into production under the auspices of the Research Council of the Academy of M. P. Arts & Sciences, presents very difficult and peculiar technical problems, as it must be photographed entirely in daylight with "night effects" filters so as to appear on the screen as having been photographed after dark. Additional photographic difficulties are introduced by the fact that the faces of all of the men appearing in the film are blackened in accordance with usual military procedure to reduce the possibilities for detection by the enemy.

gates will not welcome the televising of their programs in competition with their own box offices."

"Nothing has been said about installation and service aside from equipment costs."

Here we have the reasons for the present lethargy, except for a few real leaders in the theatres, on the part of showmen for theatre television. The most significant point of all is the fact that not one single industry representative said theatre television was impractical because of poor picture quality.

In relation to the millions of dollars that RCA has spent on television the $30-to-$40,000 a theatre would pay for equipment would hardly be a drop in the bucket compared with the money already spent without one cent of return to extend the entertainment horizon. No advertiser to the home will be able to pay what the theatres will pay for television programs of substantial proven box office merit. As Mr. Van Schmus also said: "At the Music Hall we think we are doing pretty well when we play to a capacity house of 6000; but when I go to the Yankee Stadium and see crowds of 20-, 30-, or 50,000 fans, some of whom travel great distances to see their favorites in action, I realize that if we could present these events, the crowds attending our theatres, and other theatres, would exceed our fondest dreams and imagination."

Thus we confirm a basic fact that, like the introduction of sound to the theatres, television equipment costs will not be an important factor for the new attendance at, and interest in the theatre, that it will create.

There is no newsreel, no newspaper, no radio reporting, no present method of communication or entertainment other than television which can present an event in sight and sound while that event is going on and while the final outcome or result is not known until the program is completed before one's own eyes. By comparison the present newsreel showing events from 24 hours to 60 days old, lacking any factor of suspense, and where the result or outcome has already been published in the newspapers, does a hopelessly inadequate job. Television brings news, sports and programs while they are news, rather than as a rehash of past occurrences.

The theatre today uses radio, newspapers and other media, subject to various forms of regulation, and yet is not unduly hampered by government control either in the aforementioned instances or in the shipments of its prints from city to city or state to state.

Supplements Current Programs

Theatre television is in no sense a competitor of Hollywood. Its basic function will be to supplement current program material available to theatres. The importance of new appealing program material for theatre industry having an oversupply of seats, extremely competitive product situations, the lack of appeal of most present motion pictures to day-time and particularly matinee patrons, the competition afforded movie theatres by horse racing, afternoon and evening outdoor athletic events, bridge, etc., all in the face of declining theatre admission prices warrants a warm welcome to any form of entertainment that will materially increase box-office grosses.

A study of potential program material in the New York area at present available only to the audience within traveling distance of that city and within the means of a certain number of patrons shows that out of 3,676 major attractions [including Metropolitan Opera; Yankees, Giants, and Dodger baseball games; Aqueduct, Belmont, Jamaica, Saratoga and Empire Race tracks; Madison Square Garden, *etc.*,] there were 1,195 complete sellouts.

When you note that among this total, 135 performances of the Metropolitan Opera, as well as 150 of the top-flight events from Madison Square Garden seating approximately 20,000, were sellouts, we readily agree and recognize that the best in the major box office attractions now competitive to theatres should result in increased grosses when made available to theatres.

Thus we can visualize the day when theatre television programs from these

sources will be transmitted from coast to coast by either balanced line telephone and coaxial cable or by a system of radio relay towers which, though unattended, will "bounce" the television signal across the country.

We here in the West might take a good look and see what we already have in almost made-to-order program material for theatre television. Los Angeles offers an interesting comparison between Hollywood's movies and the established box office attractions of that area ranging from the Rose Bowl football game to the Santa Anita Races. The Philharmonic (135 performances); the Auditorium (175 events); Pan Pacific (continuous), and Olympic (104); Hollywood Bowl (36); Los Angeles Coliseum (104); Stadia, such as Gilmore (104); American Legion (52); Wrigley Field (120); Santa Anita holding 30,000 people and with 64 days of racing; Hollywood Park with 20,000 grandstand and clubhouse seats over a 56-day period, and Del Mar Turf Club for a 30-day period, plus some 25 special events drawing 3,500,000 people to them, all offer an interesting source of program material for theatre television.

Taking each major city in America, imagine the opportunity theatre television will have to make these attractions available to the eyes and ears of America nationally. Certainly program material of major importance also exists beyond those mentioned.

Sponsors of these events should enjoy substantial income returns by virtue of the new market of 120,000,000 people instead of present attendance limited by the expense of an annual trip to the East or the West Coast to see the latest hits or major events.

Technical Facilities Available

Here it is important to point out that the use of wire lines or scrambled radio relay communication for these programs will insure the necessary privacy from point of origin to a theatre many miles away. Bell Laboratories have already conducted successful demonstrations over 800 miles of coaxial cable circuit in the midwest. Between New York and Washington, the coaxial cable is already installed to Philadelphia, and is being laid between Baltimore and Washington, leaving only a final link from Baltimore to Philadelphia to complete the basis for the first coaxial cable network, rather than directly into the homes as news of the day, current events, public forums, *etc.*, which will probably characterize home television of the future.

The problems of theatre television of

today are similar to the problems of radio less than 20 years ago. The problem then was to provide a radio broadcasting service that would induce millions of people to buy radio sets. But to establish that radio broadcasting service involved investments of millions of dollars—all in the hope of future returns. That investment made by RCA and other pioneers has since paid ample dividends.

The problem today is to repeat that experience of the early 1920's. Millions of dollars have already been invested to make television for the home and theatres a reality. RCA does not propose to enter every phase of theatre television—manufacture and service of equipment, production and exhibition of events—unless it is forced to do so.

RCA's major function is communication service and the manufacture and maintenance of the equipment necessary to do the job well. To the men of the theatre as an industry belong the perogatives of production, booking and exhibition, and RCA believes they will shoulder this responsibility if for no other reason—as insurance on the future of their own industry and careers.

But, one might say, there are technical problems still to be solved: transmission of pictures beyond the horizon, color television, and other difficulties. We can safely leave those problems in the hands of the engineers. They'll do their job if given the chance. The real television problem today is in the hands of business. If the leaders in the theatre are to maintain their leadership, they will recognize theatre television now and get in it at the beginning.

If you recognize the aforementioned facts concerning theatre television and its future in relation to the theatre, then it is obvious that in the not too distant post war period there will be a great new major force harnessed and functioning for you in the theatre industry.

Time To Plan is Now

Once theatre television gets underway, once theatre men realize, that like sound in 1929-30, theatre television is a new factor in entertainment, it will spread and grow as "talkies" did. A revolution comparable to that in the theatre inspired by the success of the "Jazz Singer," creating overnight a demand for talking pictures, will be at hand, and bring with it far-reaching changes in the theatre industry and its personnel.

Again, what we need is to look ahead. The invention of radio, the airplane, typewriter, telephone, the telegraph, steam engine, steamboat and other developments too countless to mention were held up to ridicule in their day. The present value of these inventions to civilization is obvious.

What theatre television needs now is encouragement, not discouragement. The more people interested in this field and

its future in relation to the theatre, the quicker will be the pace at which the problems will be solved. For, in the face of an irresistible pressure from the public for better, newer, more timely entertainment technique, engineers, manufacturers, all producer showmen will find a way of meeting all the problems that we have built up in our minds. Reactionaries may hinder and delay theatre television, but no power on this earth can stop it.

Theatre television definitely appears to be one of the outstanding achievements and developments of the post war period. It is not too early now to make plans to be ready for it.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933,

Of INTERNATIONAL PROJECTIONIST published monthly at New York, N. Y., for October 1, 1940.

State of New York
County of New York } ss.

Before me, a Notary Public in and for the State and county aforesaid, personally appeared James J. Finn, who, having been duly sworn according to law, deposes and says that he is the Editor of INTERNATIONAL PROJECTIONIST and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, James J. Finn Publishing Corp., 580 Fifth Avenue, New York, N. Y.

Editor, James J. Finn, 580 Fifth Avenue, New York, N. Y.

Managing Editor, None.

Business Manager, Ruth Entracht, 580 Fifth Avenue, New York, N. Y.

2. That the owner is:

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James J. Finn, 580 Fifth Avenue, New York, N. Y.

Ruth Entracht, 580 Fifth Avenue, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JAMES J. FINN, Editor

Sworn to and subscribed before me this 30th day of September, 1940.

(Seal) OTTAVIO GRIMALDI

Notary Public, Nassau County Clerk's No. 2599. Certificate filed in New York County No. 2-G-692; New York County Register's No. 1160. My commission expires March 30, 1942.

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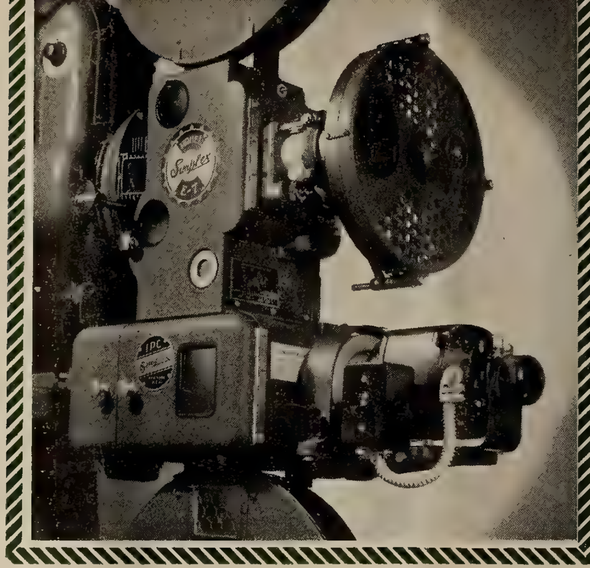

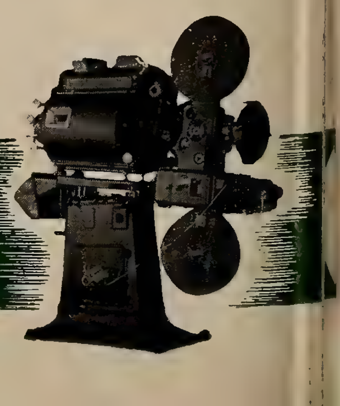

INTERNATIONAL

PROJECTIONIST

OCTOBER 1941

VOLUME 16 • NUMBER 10

25c A COPY • $2 A YEAR

It must *Sparkle!*

In this time of stress and anxiety, wholesome amusements can play a big part in upbuilding and maintaining the public morale.—FRANKLIN D. ROOSEVELT

Just as a Christmas tree must sparkle with all its trimmings to be attractive and beautiful, so too, must the pictures on your screen today sparkle to attract theatregoers.

To secure the desired screen brilliancy with present dense black and white and colored films, TWICE AS MUCH LIGHT is required as is possible to project by any low-intensity lamp.

This necessary doubling in light is possible at an increased combined current and carbon cost of LESS THAN 2c PER HOUR, with the low-cost Strong Utility High-Intensity Projection Arc Lamp.

Without the snow-white light such as is secured by this lamp it is impossible to show colored films satisfactorily. The light of your old low-intensity will appear a dim, muddy yellow by comparison. Increase your business by installing Strong Utility One-Kilowatt Arc Lamps now. Theatregoers readily recognize good projection and go where it is offered.

FREE DEMONSTRATION

Write your Independent Theatre Supply Dealer today for literature or have him arrange a demonstration in your theatre without obligation. Strong products for years have been recognized by thousands of theatres as the most dependable guide to best projection. Complete details will be sent on request by The Strong Electric Corporation, 2501 Lagrange St., Toledo, Ohio. Export office: 90 Gold Street, New York City.

Looking at the sound picture from the projectionist's port-hole

International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

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Monthly Chat

TWO items anent recent happenings, within and without the theatre field, call for comment at this time. First, and of more immediate pressing importance and personal concern to projectionists, is the story unfolded by Government reports which show that the overall cost of living has risen approximately 15 per cent within the past year. And, significantly, this advance is related not to increased taxes (those due in March will boost the "cost of living" by a goodly margin) but rather to those everyday necessities of life—food and clothing.

These figures are of great moment to every working man. They serve to demolish the argument of those carping critics who say that the organized craft is something less than 100 per cent patriotic when they ask for wage increases at this time. Also, when viewed in the light of the vastly increased earnings of the major theatre chains throughout the country (take a look at the recent earnings statements, after taxes and depreciation charges, of Loew's, Warners, Paramount, *et al*) there is no reason in the world for hesitancy in asking for a greater return to Labor for its efforts in building such imposing profit figures.

One other angle of the present situation is worth serious consideration, that being the utter fallacy of executing long-term wage contracts (for example, several of the five-year variety that have been signed in this field) without including therein some provision for revision in the light of circumstances such as exist at present. While we don't know exactly what can be done at this date to correct this unbalance between contract wages and corporation profits, we do know that all contracts currently expiring should be renewed only at a higher rate, come hell or high water. Our memory of those unlamented "depression years" is keen enough to give us a clear picture of the scramble that ensued when the production and exhibition forces stumbled over each other in an effort to be first at the door of Labor with a request for a "temporary" cut. In most instances, these cuts were granted (and on top of that was superimposed a few "summer cuts") which is the best possible argument as to why the process should now go into reverse in favor of Labor—but quick.

• • •

Anent the materials shortage. It is not yet too late to order now that equipment that will be needed later this year. Concentrate on parts replacement order, in addition to changeovers, exciter lamps, p.e. cells, tungar bulbs, and tubes.

INTERNATIONAL PROJECTIONIST

VOLUME XVI OCTOBER 1941 NUMBER 10

Projectionist—Cameraman Partnership

By *DANIEL B. CLARK*

EXECUTIVE DIRECTOR OF PHOTOGRAPHY
20TH CENTURY-FOX STUDIOS

MUCH has been written and said regarding the cooperation between cameramen and the various other departments necessary in the making of motion pictures. Time and experience have proved that too much stress cannot be laid upon the importance of coordination and cooperation among all departments and the cameramen in the adaptation, composing and photographing of stories for the screen. These are accepted facts which are generally practiced throughout the motion picture industry insofar as physically composing a motion picture is concerned.

The writer is of the opinion that there is one great step necessary for perfect screen display, which, through the years, has been overlooked, or perhaps generally neglected: that is, a closer cooperation between the cameraman and the projectionist, whose business it is to take the unified work of the writers, director, cameraman and laboratory, and, with his professional tools, project upon the screen the final treatment which must be presented to John Public for approval or disapproval.

The projectionist's work is the ultimate answer to the successful display of all pictures.

Projectionists throughout the country are, or should be, artists in their own right. This is proven by the fact that some of the world's greatest directors of photography come from the ranks of projectionists. The artistic ability of the projectionist is not always apparent, probably because of the fact that they are submerged in a room where they are never seen, seldom ever heard from in the light of their extreme responsibility. In many cases they themselves do not fully appreciate their responsible position in the great industry of which they are of such vast importance.

Much Deficient Equipment

All too often the cameraman struggles to and does achieve an artistic photographic product; but when viewed on the screen it lacks definition and quality comparable to his efforts. The reasons for this error are various and sundry, such as inadequate equipment in machines, lenses, screens, *etc.* There are known cases wherein the projection and screen display is impossible.

Yet the manager of the theatre ignores the fact and, instead, spends large sums of money on fancy rugs and tapestries for the lobby. In many cases, however, the fault undoubtedly lies with the projectionist, who, through lack of desire to cooperate or because of a misunderstanding of his responsibility, fails to note and bring these facts to the attention of the proper authority.

Fortunately, the vast majority of projectionists are men who *do* realize their importance and who are willing to accept the responsibility which is theirs alone. By cooperation and understanding they constantly strive to keep abreast of the many problems which they alone can solve.

It then becomes the projectionist's duty to reverse the cameraman's efforts and, through the medium of his mechanical and optical arrangement, coupled with artistic understanding, transfer the same tiny picture, magnified at least 5,000 times, back to the set or landscape which is more commonly known as the screen—the final result which is viewed by millions of theatregoers throughout the world.

Does it not then become apparent that these two great factors in the motion picture world should strive for a closer cooperation and better partnership in order that they may benefit each other in solving the innumerable problems with which they are continually confronted, and so that they both may better serve the great industry which they represent, as well as the vast army of

theatre patrons who are, and always will be, the judges who will bestow the final reward of merit?

Now for the four other component parts. Second, The Sound Department as a whole: (a) The Mixer, working on the set with the director and photographer and, in the same category, the boom man, handling that ever-important "mike"; (b) the recorder, who is responsible for the correct recording of sound on film.

Third, the film editor or cutter: (a) the picture editor, who handles the direct continuity of the picture and story; (b) the music editor, who handles all incidental and background music; (c) the re-recording and dubbing, or the sound effects editor, who puts in the background effects (usually the final stage) before the print is turned over to the laboratory for a pre-view print.

It is the opinion of the writer that the projectionist who has charge of the dubbing department of any studio has, without doubt, the most nerve-wracking job projectionists are required to do. As in the case of the dubbing room of the Columbia studio, under the supervision of Howard Edgar, and presided over by Sam Shapiro and C. E. Richards, of Local Union 165, these boys have five dummies and a projection machine to handle when running at full capacity. This is one spot in the studio where absolute cooperation between the projectionists and other branches of the industry is demanded, and received.

Fourth, the Laboratory: developing the original negative (both picture and sound track); printing and developing the positive prints for the cutter; the final printing and developing of the positive prints for the finished product. The print is now ready for the public to see, and all the work of the aforementioned technicians is turned over to the next and final stage of production.

Fifth, the projectionist: (a) studio (b) theatre.

This may seem a long and arduous route to take the reader over to the final summing up, but it has made clear the necessity for close cooperation between the director of photography and the projectionist. The first and last parts of the whole can either make or ruin the work of all the other technicians mentioned.

Projection All-Important

Just who is this all-important being, the projectionist, and how does he fit so vitally into the picture industry? Let's go back for a brief glimpse to the very beginning of this story.

The cinematographer photographs a scene that is sent to the laboratory. Directly a positive print is made of the scene and it is then run through the laboratory projection machine, which is the first check for flaws of all sorts. Then the print is sent to the editorial department where it is run in another projection room for the production editor, the director and photographer for mistakes in action, lighting, dialog and sound.

From this point on this particular scene will be run through a projection machine at least once a day, and sometimes it will be necessary for an editor to run it fifteen to twenty times consecutively to cut a fast action scene. It then is sent to the dubbing room for final effects, after which it is ready for delivery to the theatre projectionist, who will present it to the paying public. It will be readily seen that all departments depend on the projectionist to check up on the work they have done, so to this point the projectionist is obviously a personage. But why stop here? Let us go on to the other projectionist, in the theatre.

The theatre projectionist is, generally speaking, a blood brother of the studio projectionist, but still the technique is different. In the theatre there are a number of things under the care of the projectionist that do not apply to the studio projectionist. For instance, in the theatre projection room there are usually dimmers, curtain controls, motor generators, sound systems, repairs and maintenance, the building up and tearing down of shows, curtain and sound cues, house lighting, building up the trailers and the ensuing day's strips, spot lighting for stage presentations, and effect machines. In the usual neighborhood theatre the projectionist is on his own; on his shoulders rests the responsibility of seeing the show through.

It is quite true that most of the modern equipment is automatic in action, but the incoming voltage will vary, this or that vacuum tube will weaken from age, the film will need attention from wear, the carbon that was just installed in the lamp house is a trifle smaller or was not compressed as hard as the one before it, causing a slight change in resistance and, therefore, a slight change in the light quality.

Projectionist-Cameraman Ties

The audience knows only that they paid to see a perfect picture; if that is not forthcoming—well? They do not know that the laboratory is at fault, or that perhaps the printing was deficient. All the audience knows is that the picture was dull and uninteresting. They also saw the name of the photographer on the credit title, and they know, vaguely, that there is a man in the little room up near the ceiling who is putting the picture out of a little hole in the wall. If it doesn't get on the screen correctly, someone is to blame, be it photographer or projectionist.

So if there is any group of men that should get together and be of mutual assistance to each other, it is the photographer and the projectionist. Together they can make or break almost any production on which the studios have spent hundreds of thousands of dollars, or they can assist materially in saving a so-called "stinkeroo." Many poor stories have been saved by beautiful photography and perfect projection. These two crafts should walk hand in hand in all their endeavors.

Projectionist's Creed

"When a man has a practical knowledge of optics, electricity and mechanics; has learned how to handle a delicate and inflammable material in conjunction with a high-amperage illuminant; when he knows time, color and sound; has experienced the peculiarity of managers and the sensibility of actors and musicians; has learned how to work irregular hours during 365 days of the year; when he can work effectively with constantly changing associates in what is all too often an improperly designed and constructed projection room—when he has merged all this, he becomes a showman and a projectionist".

LESTER B. ISAAC
Director of Projection, Loew's Theatres.

Harry Rubin's 35th Anniversary

A testimonial dinner was tendered recently to Harry Rubin, director of projection for Paramount Theatres, on the occasion of the fifteenth anniversary of the opening of the N. Y. Paramount Theatre. The entire personnel of the Paramount projection staffs in N. Y. City—theatres, review rooms, studio, and newsreels—were hosts to many of Rubin's associates in the industry. Among the speakers were Dr. A. N. Goldsmith, former president and currently a governor of the SMPE; Jim Lynette, supervising inspector, and Bart Green, chief Manhattan inspector, of the Dept. of Water, Gas & Electricity of N. Y. City; P. A. McGuire, advertising manager of International Projector Corp.; Joseph Basson, president of Local 306; Robert Weitman, managing director, and Paul Brocco, stage manager, of the Paramount; Jesse Hopkins, for many years assistant to Rubin, and James J. Finn, editor of I.P.

The occasion also marked Rubin's 35th year as a projectionist.

Multiple-Speaker Reproducing Systems For Sound Motion Pictures†

By *H. I. REISKIND*

RCA MANUFACTURING CO., INC.

Several types of multiple-speaker reproducing systems have been demonstrated and used during the past two years. For general theatre use such a system must be simple and must employ a release print that is interchangeable with standard release prints. The use of a number of loudspeaker systems spread across the front of the theatre and operating in parallel will effect a material improvement in the reproduction of music and "sound effects." By providing supplementary speakers well to the sides of the screen, operated by a control track so that they are faded out during dialog, an improvement in music and effects reproduction is obtained without harming dialog.

The sprocket-hole area may be used for the control track, thus eliminating the necessity of changing existing film standards or obsoleting reproducer equipments.

DURING the past two years a great deal of interest has grown up in the industry with regard to the improvements in reproduction which may be obtained by the use of multiple-speaker systems for sound motion picture reproduction. Not only have there been demonstrations of such systems but several pictures have been released for multiple-speaker reproduction.

One of these, Walt Disney's *Fantasia,*[1] makes use of special road-show prints and reproducing equipment; while several Warner Bros. pictures have been released as standard type prints including a sprocket-hole control track and shown on standard reproducing equipment modified to provide multiple-speaker reproduction.

In general, two methods are employed and all the systems make use of either one or some combination of the two. One. the stereophonic method, uses two or three channels to produce motion of the sound source and thus allows the sound to follow the picture within the confines of the screen and in some cases to produce "off screen" effects. The other method makes no attempt to provide sound motion within the screen area. Instead, the sound source for music and sound effects, which generally are not localized on the screen, is broadened beyond the screen area by the use of multipled groups of loud speakers.

A committee composed of members of the various Hollywood studios has been set up under the Academy of M. P. Arts and Sciences and is engaged in studying the various systems with the view of standardizing one of them for general industry use.

Five Basic Requirements

With this amount of activity in the field it was felt that a discussion of some of the aspects of multiple-speaker reproduction and of one of the proposed systems would be of interest to the field.

It is of course understood that everyone is interested in standardizing a system that will be practicable for the majority of motion picture theatres. In order that it be generally acceptable the system should satisfy these five requirements:

(1) It should make an improvement in the dramatic quality of the motion picture presentation that will justify the cost of the change.

(2) The cost of the additional equipment should be low enough to make it practicable for the smaller as well as the larger theatres.

(3) Present standards of film, picture, and sound-track dimensions should not be changed in any way that will require modification of existing equipment except to provide the improved reproducing characteristics.

(4) Existing theatre equipment of modern types should not be rendered obsolete. The improved reproduction characteristics should be obtainable by additions to the installed equipment.

(5) The modified equipment must reproduce sound from the present standard release films without any deterioration in quality over that which would be obtained from existing standard equipment. Release prints prepared for the improved type of reproduction should be reproduced on standard equipment with quality as good as would be obtained from a standard print.

It is possible, even within the limits of these requirements, to make a noticeable improvement in reproduction by taking advantage of the differences between what constitutes the most favorable conditions for reproducing dialog and music. It has been recognized almost from the earliest days of sound motion picture recording, that dailog represents a recording and reproducing problem that is entirely different from that presented by music, choruses, or sound-effect scenes. We might distinguish between the two types by saying that the original speech is produced by approximately a point-source, while the original source of music and the sounds of most spectacular effect-scenes is one of large area.

The motion picture technic used for dialog scenes is one that plays almost all the action in medium or close shots. In order to improve both illusion and intelligibility we are interested in obtaining a high degree of "presence"; that is, we should like to get the effect of the sound coming from just in front of the screen.

Because of the limited size of the screen the technic is one of always bringing the action in front of the viewer rather than having him look toward the action; and in general it can be said that there is comparatively little motion in the scene with respect to the viewer. It must be recognized also that even when there is motion on the screen, the angle subtended by the screen at the eyes of most of the viewers is quite small, and consequently the viewers are seldom conscious of such motion.

On the basis of SMPE Recommended Practice, the screen subtends an angle of about 16½ degrees at the eye of an observer in the middle of the theater. Particularly in a theater with a balcony, the angle at the majority of seats is even smaller.

Music and sound effects present an entirely different problem. Not only are they generally produced over a large

† J. Soc. Mot. Pict. Eng., August, 1941.

[1] Kowalski, R. J.: "RCA's 'Fantasound' System as Used for Disney's 'Fantasia.' *Internat. Project.* (Nov., 1940), p. 20.

area, but in most instances the source of the music is not pictured on the screen, and we are more interested in obtaining a spatial effect than in localizing the source of the sound.

A very similar condition applies in the spectacular type of sound-effect scene, such as the earthquake of *San Francisco*, the avalanche of *Lost Horizon*, or the battle in *The Sea Hawk*. Here we are interested in obtaining the illusion of sound coming from an area much greater than that pictured on the screen and the effectiveness of the scene would be enhanced by having the sound come from the entire front of the theater or in certain cases even have the audience entirely surrounded by the sound source.

We are able to differentiate between the various types of scenes in the recording operation and provide the microphone placement and acoustic environment best suited to each scene. However, in reproduction it has been the practice to use the same speaker system at all times. Because of the importance of the dialog in telling the story, our speaker systems have evolved into a form that is particularly well adapted to give a high degree of intelligibility and presence.

The single set of speakers located back of the screen tends to approach a point-source, and while this is exactly what is needed to give maximum clarity and presence for dialog, it tends to give music a "squeezed" effect, particularly in a large theater. The comparison is especially striking when it is made between an actual orchestra and music reproduced through a single speaker system in the same theater.

Methods have been developed for overcoming this "squeezed" effect by the use of multiple sound-tracks and reproducing channels. The possibilities of auditory perspective have been demonstrated by the Bell Telephone Laboratories on several occasions.

Another method of attacking the problem is based upon the idea that exact imitation of the original may not be our goal in the reproduction of music. Many persons, including musicians, feel that the sound from a real orchestra may not be the ultimate in impressiveness. The belief has been expressed that a better effect might be obtained from an orchestra if the violins, for example, instead of being seated in a group, were intermingled with the other instruments. In some ways reverberation produces a little of this effect in that it brings the sound to the listener from many directions and thus reduces the effect of definite location.

It is accepted that a large amount of reverberation is necessary to make music pleasing. However, intermingling the instruments is impracticable from the players' standpoint, since it is largely because of the grouping that each section of instruments is able to play together, both as to tempo and pitch. Such an arrangement, however, can be accomplished in a reproducing system by several groups of speakers in multiple spread across the front of the theater.

The effectiveness of this method of reproducing music was demonstrated in 1937 in the RCA sound reproducing system installed for the production *The Eternal Road*, where individual sound-tracks, reproducing channels, and speaker systems were employed for the orchestra, choruses, and soloists. The individual solo and chorus channels allowed speaker placements giving the desired illusion of location. The orchestra music, which had been recorded on a single sound-track, was reproduced through a number of loud speaker systems spread across the front of the theater.

This use of multipled speaker systems provided a large sound-emitting area more nearly approximating the original source than did the single-speaker system. This system did not localize the position of each instrument, but added a "spread" or spatial effect and gave the impression that the music actually filled the auditorium rather than that it came from a definite source at the center of the stage.

The effectiveness of the multiple-speaker system for music and effects has also been demonstrated by the sound-reinforcing system installed in the Radio City Music Hall (N.Y.). This system consists of three individual amplifier channels feeding three banks of speakers. One bank is located to the right, one to the left, and one above the center of the stage, and the system is arranged so that the three channels may be used individually or in parallel.

Comparative tests almost six years ago convinced both the Music and Sound departments of the Music Hall that their multiple-speaker method gave more effective and pleasing reinforcement and more nearly simulated the effect of a large orchestra playing in a large auditorium than the use of three separate discrete channels.

The "Fantasound" system of reproduction is an example of the possibilities of combining both stereophonic reproduction and the principle of extending the source. Both methods are used in this picture, depending upon the effect desired. The "Ave Maria" number, which many consider the most impressive part of the performance, is an example of the results that may be obtained with multiple-speaker reproduction. For this selection a large number of speakers were installed along the sides and back of the theater and multiplied to the corresponding set of side speakers on the stage. In this way the sound from each side sound-track was reproduced along the entire corresponding side of the house rather than from the stage alone.

Another example of the effectiveness of surrounding the audience by the sound source is the reproducing equipment installed for the RCA large-screen television demonstration at the New Yorker Theater. Loud speakers in multiple, located on all the walls and on the ceiling, as well as on the stage, materially improved the sound illusion, and in one scene were used to make the audience feel that they were actually being subjected to a bombing attack.

The improvement in music and effect reproduction obtainable through the use of multipled groups of speakers, and the development by C. M. Burrill of a method of using the sprocket-hole area

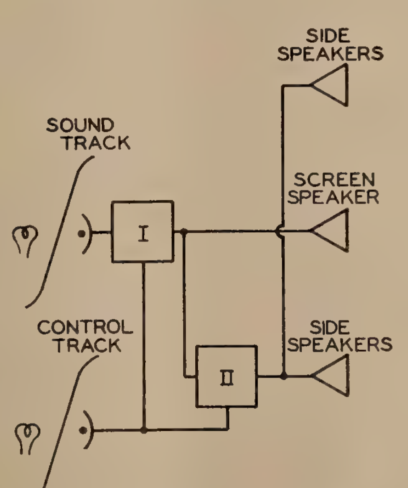


FIGURE 1

Simplified block diagram of a multiple-speaker reproducing system.

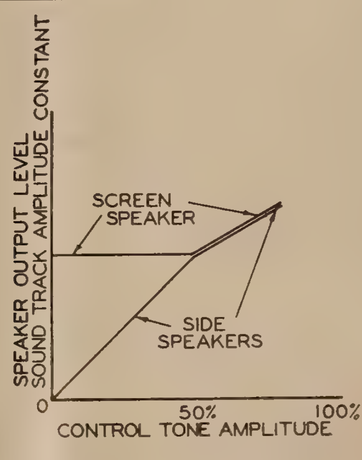
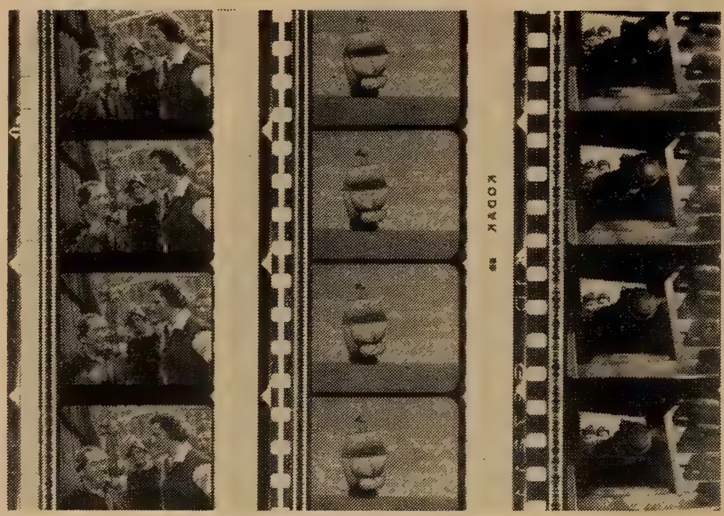


FIGURE 2

Output characteristics of loud speaker groups in a multiple-speaker system.



a *b* *c*

(Courtesy Warner Bros. Pictures, Inc.)

FIGURE 3. *Composite release print with sprocket-hole control track: (a) Minimum modulation. (b) Intermediate modulation. (c) Maximum modulation.*

of the film to provide a control signal, led M. C. Batsel to propose that a commercially practicable multiple-speaker reproducing system be developed for motion picture theaters.

This could be done by equipping theaters with additional speakers located well to the sides of the screen and arranging the control equipment so that these supplementary speakers would operate in parallel with the screen speakers during all music and effect sequences, but be off during dialog. This arrangement would provide a spatial effect or "acoustic spread" for the music and effects reproduction and still maintain the intelligibility and "presence" of the dialog, since dialog will be reproduced exactly as at present.

In addition to "acoustic spread," consideration was given to the desirability of providing increased volume range. It was recently pointed out by W. A. Mueller, that the permissible volume range of reproduced dialog is limited by theater and audience noise at one end, and at the other by the maximum loudness to which the audience can comfortably listen. This range is less than the volume range of existing film recording methods, and it was therefore not considered necessary to have any volume control for dialog scenes.

Mr. Mueller pointed out also that with standard reproduction, audiences generally object to music reproduced at levels much higher than those used for dialog. However, tests made of music reproduction with acoustic spread indicated that higher levels could be used without discomfort and with consequent improvement in the effectiveness of the music.

The spectacular type of effect sequences, hurricanes, battles, and so forth, which of course call for increased reproducer gain, are also improved by acoustic spread.

Since it appears that all those sequences that may require increased reproducer volume are also benefited by acoustic spread, it was decided that the system would be arranged so that as the control tone was increased it would first provide acoustic spread by fading in the supplementary side speakers and then control the volume of the entire system.

An Acceptable System

An elementary block diagram of such a system is shown in Fig. 1. The control circuits are designed so that with the minimum control signal, unit *I* has a gain that is less than its maximum gain, and unit *II* is off. This represents the dialog reproducing condition (screen speaker operating, side speakers off). For music or effect reproduction at normal levels, the control signal amplitude may be increased to about 50 per cent, operating unit *II* and turning on the side speakers. Any further increase in control tone amplitude has no effect upon the gain of unit *II*.

Unit *I* is designed so that its gain (which represents the overall system gain) is unchanged by the increase of the control signal to 50 per cent, but a further increase (from 50 to 100 per cent) will increase its gain, and thus increase the loudness of both screen and side speakers. The relation between speaker outputs and control tone amplitude is shown in Fig. 2.

This system requires a single-frequency control tone variable only in amplitude. Such a tone might be recorded on the portion of the film outside the sprocket-holes, between the sound-track and the picture, or standards could be changed and a portion of the sound-track area utilized. However, the proposal of C. M. Burrill to use the sprocket-hole area appears to be the most practicable since it requires no changes in existing standards. Such a track can be recorded and printed very easily, and can be reproduced by a very simple and inexpensive attachment to the sound-head.

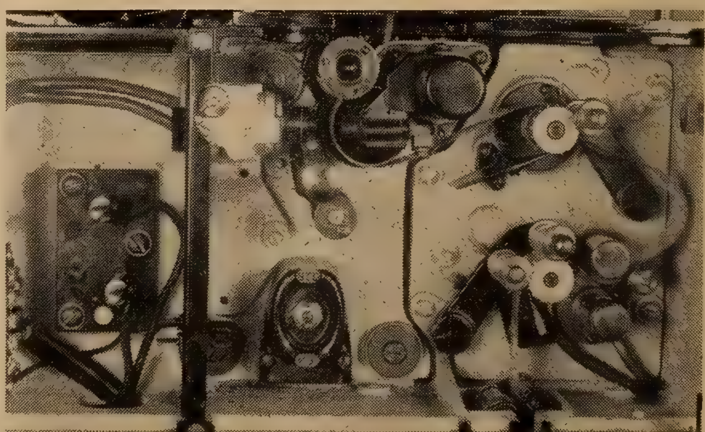
When the sprocket-hole area is scanned, a 96-cycle tone is generated. The positive half-wave will have an amplitude dependent upon the amount of light passing through the hole, while the negative half-wave amplitude will be determined by the light passing through the "lands" (the spaces between the sprocket-holes).

Accordingly, the 96-cycle control tone may be varied in amplitude simply by changing the transmission of the "lands." Maximum signal is obtained when the "lands" are all black, and minimum when they are clear. Fig. 3 is a photograph of three portions of a composite release print showing the track for minimum, maximum, and intermediate values of control tone.

Since the track occupies the entire width of the sprocket-hole area and the frequency to be reproduced is low, a very large aperture may be used. This makes possible the very simple scanning system

FIGURE 5

Sprocket-hole control track scanning system mounted in a standard soundhead.



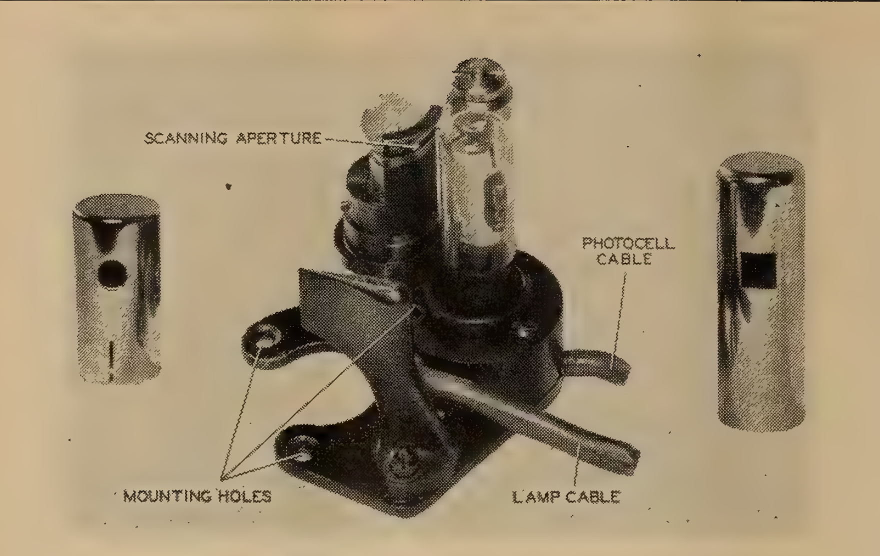


FIGURE 4. *Sprocket-hole control track scanning system.*

shown in Fig. 4. The lamp is rated at 6.5 volts, 0.43 ampere, and because of the large aperture, furnishes more than sufficient light without the use of any lenses. The signal output of this simple scanning system is higher than that from a normal sound-track scanned by a standard optical system, thus allowing the use of a reasonably low-gain amplifier.

Large Tolerances Allowable

A further advantage of this track lies in the large tolerances allowable in recording, processing, and reproducing. It will be noted that it has not been necessary to provide any lateral guide adjustment of the scanning assembly. Fig. 5 shows the system mounted in a standard sound-head. The unit mounts around the hold-back sprocket and requires practically no modification to the sound-head.

In any reproducing system it is desirable that the signal amplitude be independent of exciter lamp output or photocell sensitivity. Fortunately, this result can be obtained in the reproduction of the control tone by a very simple method which makes use of the logarithmic relation existing between the grid current and the plate voltage of any vacuum tube. With a circuit using this characteristic it is possible to vary the exciter lamp intensity by more than 5 to 1 with a change in output of less than 1.5db. With a linear amplifier, this same variation in exciter lamp intensity would produce a change in output of over 14 db.

The system described herein meets all the requirements laid down at the beginning of this discussion. By requiring only that all prints not recorded for control track reproduction have a clear sprocket-hole area, complete interchangeability of prints is obtained and it will not be necessary for exchanges to carry two types of prints for any picture. In addition, the system is simple; any modern system can be modified to provide multiple-speaker reproduction, and the improvement obtained is a real one.

Warner's 'Vitasound' Theatre System

By *NATHAN LEVINSON and L. T. GOLDSMITH*

IT has been long recognized in the motion picture industry that an increased dramatic use of sound in the theatre would add to the enjoyment and realism of sound pictures. Two features that would contribute to this realism of music and sound effects are an increased volume range and a spreading of the source of sound.

It has been pointed out that an increased volume range is neither necessary nor desirable for dialog reproduction, but that for music and sound effects an increase in the effective volume range of signal to auditorium or film noise of approximately 10 decibels is both practicable and desirable.

As the volume range on the sound-track is limited by the available volume range of the film itself, an effective increased range can be secured by automatically raising and lowering the gain of the reproducing amplifiers in the theatre.

The spreading of the source of sound can be accomplished by adding loudspeaker systems outside the screen area. These added speakers, however, can reduce the illusion of the dialog coming from the screen if not properly placed and operated. The additional speakers may be automatically cut in the circuit for music and sound-effects, and cut out of the circuit for dialog.

Additional reproducing equipment to accomplish these aims for the majority of feature films must be readily adaptable to the modern types of sound equipment found in the well-equipped theatres. Also, the cost of the modification to the theatre must be a reasonable one and the costs of operation, maintenance, and service must not be increased.

The Vitasound Development

The Vitasound system was developed with the foregoing considerations in mind. A control-track printed in the sprocket-hole area of standard release prints is employed to operate a variable-gain amplifier to secure the increased effective volume range and to operate a loudspeaker switching relay for extending the source of sound to loud speakers beyond the screen.

Figure 1 shows three different sample widths of control-track as it appears on a standard composite release print. The two top frames have no operable control-track because the clear portion between the sprocket-holes is 110 mils

FIGURE 1. *Composite print with sprocket-hole control-track.*

[1] J. Soc. Mot. Pict. Eng., Aug., 1941.

wide, or as wide as the sprocket-holes themselves.

The two central frames have a control-track 40 mils wide, which serves to cut in the side speakers automatically by means of the relay control.

The two bottom frames have an almost completely closed or zero-width track which, in addition to operating the side speaker relay, is used also to increase the gain of the variable-gain amplifier by 10 db. Any intermediate width of control-track between 40 mils and zero may be printed to secure gain increases from zero to 10 db.

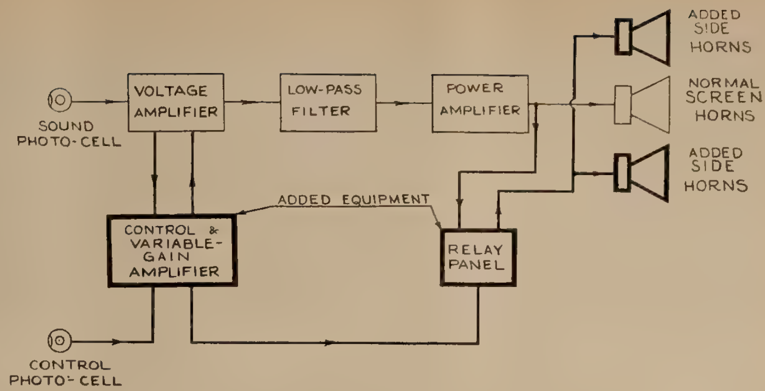


FIGURE 3 *Block diagram of control-track apparatus.*

The control-track is scanned in the sound-head by a separate photocell at a point 14 frames ahead of the sound-scanning point. The point on the control-track corresponding to the sound on the sound-track is therefore printed 14 frames nearer the head end of the reel.

Figure 2 shows the scanning bracket mounted in a soundhead around the hold-back sprocket. The scanning aperture is a 90 by 90-mil square opening cut in a shoe on the bracket which also supports a small 6-8-volt, 0.4-ampere lamp and a type *927* photocell. No optical system is necessary, and the film is threaded over the sprocket in the normal manner.

Character of Additions

The control frequency is 96 cycles and varies in amplitude with the width of the clear portion of the film between the sprocket-holes. The output of the control-track photocell of each projection machine is connected by a low-capacity cable to a combination control-tone amplifier and variable-gain amplifier.

Figure 3 is a block diagram of a typical sound-reproducing system modified for control-track operation. The heavy lines indicate the equipment added for Vitasound. The variable-gain amplifier has a normal zero insertion gain and is electrically connected in a 500-ohm link circuit between stages of the voltage amplifier. A speaker relay panel also operates from the control amplifier and closes the side horn circuit at the output of the power amplifier. The power amplifier must have sufficient power capacity for a 10-db increased output when maximum control is utilized.

The side horns are each equal to one-half of the screen horn system in power-handling capacity and are of the same type so that the same amplifier equalization serves for both horn systems. The additional horns may be located at or near the sides of the proscenium arch in a line with the center horns.

Figure 4 shows how the relay panel and combined control-tone and variable-gain amplifier are added to the existing rack of a typical sound system, in this case an RCA *PG-92*. In the case of cabinet-mounted amplifier systems, the same control-track equipment can be furnished mounted in wall cabinets. Both units of the control-track equipment have self-contained power supplies which are so regulated as to be independent of line-voltage variations from 90 to 130 volts.

The variable-gain amplifier has two screwdriver adjustments: one for the point of gain increase, and one for the degree of maximum gain. A "normal-control" key serves to by-pass the amplifier if no control is desired. The relay panel has one screwdriver control for sensitivity. This adjustment is necessary only at the time of installation in order that the relay may operate to cut in the side horns at a control-track width of 40 mils or less.

Figure 5 shows how the system gain is increased almost linearly over a 10-db

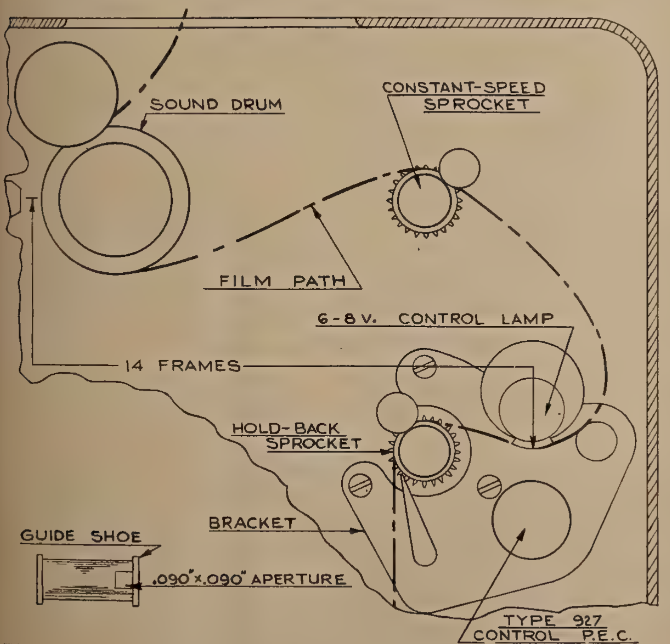
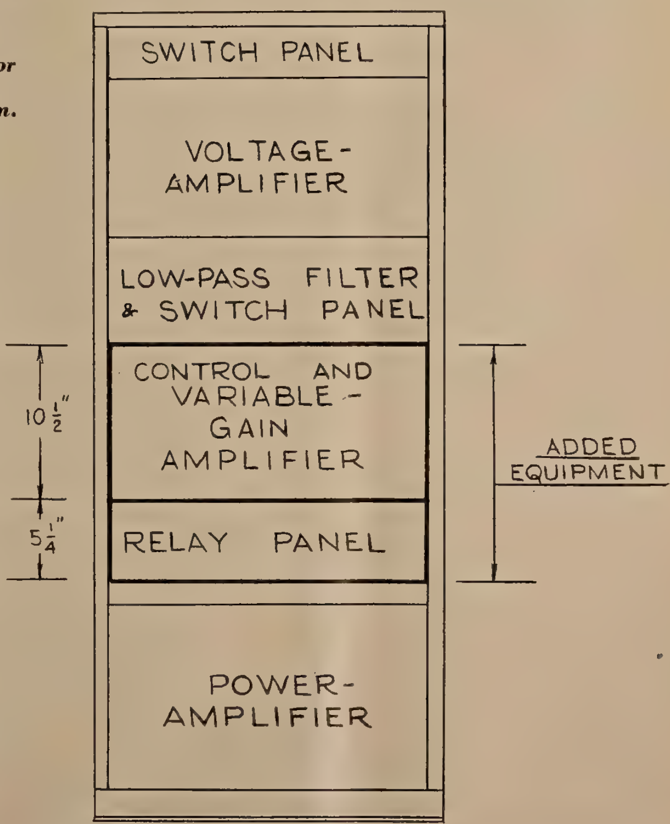


FIGURE 2. ***Sound-head scanning bracket for sprocket-hole control track.***

FIGURE 4

Rack mounting for typical sound-reproducing system.



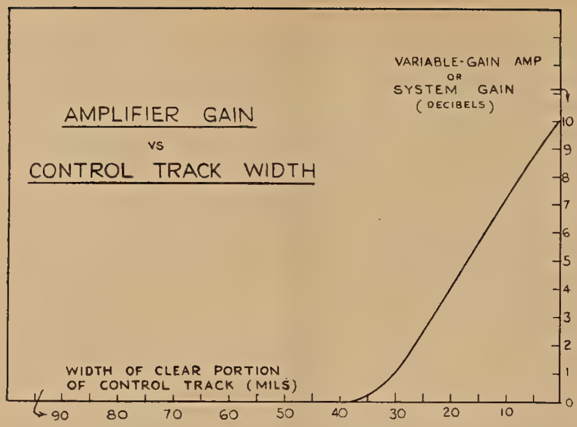


FIGURE 5

Amplifier gain vs. control-track width.

range with a 40 to zero-mil change in width of the control-track. At present, the scanned width from 90 to 40 mils is not used. The operating time of the control equipment is of the order of 60 milliseconds, which is fast enough to allow full control on effects and music sections of short duration.

Control-Track Preparation

In practice the control-track is prepared on the film in the following manner: A control-track print is made up by splicing together prints of various widths appropriate to the degree of control desired. These tracks are available in the re-recording department in steps of 1 db. This cut control-track print is used for the production of a separate control-track negative, or is printed onto the undeveloped sound-track negative in order that release prints can be made from a separate control negative or from a composite control-sound negative as desired.

The release composite print is then made in the normal manner, except that the sound-track printer is equipped to print both the sound-track and control-track in one operation. There is no change in technic or increase in operating cost in the release laboratory in the case of composite control-sound negatives. The greater cost involved in the separate control-track method is due to the one additional printing operation.

The cut control-track print is returned to the sound department after the negative is made, where it is broken down and used again to make other cut control prints.

Release prints with control-tracks reproduce normally in theatres where the equipment has not been modified to take advantage of the control feature. Conversely, standard release prints without control-tracks reproduce normally on modified theatre equipment provided the film is threaded over the control lamp to miss the control-track attachment or that the print is clear in the area between the sprocket-holes. In either case the control equipment is inoperative.

Oil, dirt, and scratches incurred during normal print life have no appreciable effect upon the operation because of the relatively large scanning aperture employed. Track misalignment in printing, and projector weave up to 10 mils, have no effect for the same reason.

The equipment has been in use experimentally in the Warner Bros. *Hollywood Theatre* in Hollywood, and the *Strand Theatre* in New York for several months and has proved to be effective, reliable, and trouble-free in operation.

Addendum:

Mr. Reiskind: The various methods being tried out by the industry all have merit, and the problem facing us is that of picking the method that offers the best engineering and commercial compromise. It is essential that we remember that the scheme adopted must not be very expensive, must be relatively simple to operate and maintain, and must not require special prints which can be played only on the new equipment.

It seems to me that the single-sound-track scheme using the sprocket-hole control-track, which was described in detail by Messrs. Levinson and Goldsmith, offers the best compromise. While the three-track system will provide greater flexibility in obtaining dramatic effects, it does not seem that this advantage will compensate for the great increase in equipment complexity. The three-sound-track system requires three reproducing channels, complete from photocell to loud speakers, each including a variable-gain amplifier.

The system requires three control tones, and it is proposed to record these as a 5-mil track in the narrow space between the sound-track and the picture. The 5-mil track provides very low output, which will necessitate the use of additional amplification in the control system. The three band-pass filters required to separate the tones will further increase the cost of the system. Very extensive modification will be required in the sound-head to provide reproduction of the four tracks.

Different Prints Not Practicable

The possibility of employing high-speed compression and expansion will provide additional noise reduction which must first make up for the loss caused by the reduction in track width to one-third normal, and then may provide increased volume range. However, it appears to me that such a compressed print could not be satisfactorily reproduced on standard equipment. In the past we have seen several instances of the impracticability of expecting the exchanges to handle two types of prints.

I should like again to stress the factor of cost. Regardless of the improvement obtained, expensive modification will be practicable for only the largest theatres. This is directly contrary to the basic idea of the industry which aims to provide essentially the same entertainment for all audiences whether they attend large or small theatres.

Notes on the Mechanism of Seeing

BEFORE we can be explicit as to what constitutes good lighting from a physiological point of view, we must first investigate the mechanism of vision and, if possible, see what clues to good lighting can be found by an examination of the known effects of visual defects on sight. It will also be necessary to examine some of the physical factors involved in the act of seeing. By combining these two lines of approach we may hope to arrive at some general principles which can be applied to the lighting problem.

The single eye is functionally a complicated sense organ which adjusts itself without conscious effort when normal and working under proper conditions. Both eyes together with their systems of muscles, nerves, sense endings and brain constitute an automatically adjusting mechanism infinitely more complex than any mechanical system ever made by the hand of man.

If, at the moment when we first observe the individual, he has been looking at a distant, well-lighted object and at that instant turns his head to see an object close at hand, a blurred image is thrown on the retina of each eye of different brightness than the field at which he had just been looking. Also, the image on one retina is in a different position from that on the other.

Automatic Corrective Actions

Now an interesting event takes place. Both eyes move in their orbits until the visual fields both fall on approximately corresponding parts of the retina. They then perform small corrective movements while the individual is observing the new point of interest. At the same time the muscles controlling the shape of the lens operate to increase its curvature until the image is focused on the retina. The pupil has also changed in size in order to compensate for normal lens defects and because of the difference in brightness

(*Continued on page* 25)

Enlarging 16mm. Kodachrome To 35mm. Technicolor

By *WILLIAM STULL*, A.S.C.

Editor-in-Chief, AMERICAN CINEMATOGRAPHER

FOR months there have been rumors of experiments in enlarging 16mm. Kodachrome to 35mm. Technicolor. Today, those rumors are confirmed. The experiments have borne fruit: 35mm. Technicolor prints from 16mm. Kodachrome originals are a commercially-available reality. 35mm. Technicolor release-prints are being made of the first short-subject filmed in 16mm. Kodachrome by a major studio for theatrical release!

The results are astonishing: the enlarged print retains the many desirable optical qualities inherent to 16mm., and offers possibilities of convenience and economy in filming beyond anything possible in 35mm.

The first step in making the "blow-up" is the making of three selectively-filtered 35mm. color-separation negatives. This is done optically, of course, with one negative filtered to form the red record, a second filtered to form the blue record, and the third to form the green record.

Then, in Technicolor's printing-process, matrices are made from each of the three negatives — raised-gelatin relief images from which the appropriate dyes are transferred in somewhat the fashion of a rubber stamp to the positive film which comprises the final print. In this operation the red-record matrix prints the cyan (blue) image; the green matrix, magenta; and the blue matrix, yellow. This printing method is, of course, identical with that used in making Technicolor prints from any conventional 35mm. Technicolor negatives.

Throughout these processes, a very considerable amount of control is possible, so that in some instances, at least, compensation can be made to correct minor shortcomings in the contrast and color-balance of the 16mm. original. In the printing and development of the enlarged separation-negatives, a considerable degree of control of contrast is possible.

In the same way, in the making of the final print a considerable control of color-balance and density is possible, resulting in a quality quite superior to the writer's expectations. Such control is something heretofore unknown, though greatly needed, in the 16mm. commercial Kodachrome field.

The tonal range and gradation of the Technicolor enlargements screened for the writer were a revelation. There was less of the appearance of a dupe than he had considered possible. While no direct comparisons were available, tonal range and gradation in these Technicolor enlargements seemed to compare well with both direct 35mm. Technicolor and 16mm. Kodachrome.

Tests on color charts showed very excellent rendition of both saturated and pastel colors, while gray-scales were reproduced with uncommon fidelity, with excellent blacks and uncommonly clear whites. Flesh-tones were particularly pleasing. While not on a par with the best possible in major-studio 35mm. Technicolor, the flesh rendition is definitely the best we've seen in any Kodachrome enlargements, and much cleaner than is general in even the best 16mm. Kodachrome dupes.

The optical quality of these enlargements proved another pleasant surprise. The perspective and depth of field given by the 25mm. lenses customarily used for 16mm. are, of course, retained in the enlargement, and the result, from 35mm. and on a large screen, seemed almost uncanny. There was depth there that could not be approached in any 35mm. without risking the often distorting perspective of a wide-angle lens. What can be done with an enlargement made from a 16mm. Kodachrome photographed through the normal substandard wide-angle objectives—20mm. and 15mm.—should be a revelation on the screen.

The steadiness shown in all of the enlarged prints is another amazing thing. We are accustomed to look upon steadiness as something more or less exclusive to 35mm. film and professional equipment: but these enlargements, by whatever process made, prove that 16mm. Kodachrome, filmed in a properly-handled, high-grade 16mm. camera is certainly steady enough for most professional purposes. Frankly, we've seen less steady films made in 35mm. with some of our best professional cameras.

The excellent definition possible in these enlargements explodes another fallacy. Theoretically, it would be expected that definition must naturally suffer through the various duping, enlarging and reprinting processes involved in making these 16mm.-to-35mm. enlargements. But this does not seem to be the case. Where the original 16mm. Kodachrome is adequately defined, the definition of the enlarged print appears to remain entirely satisfactory.

As a matter of fact, seeing some of these enlarged prints projected on a screen more than twelve feet wide, we would be inclined to say the definition was at least equal to that which would be obtained projecting the original 16mm. to similar dimensions. In some instances, the definition appeared even to surpass that expectable in the original.

Grain-size in the enlarged Kodachrome-Technicolor 35mm. color-print is another pleasurable surprise. In conventional black-and-white practice we have been accustomed to think of greatly exaggerated graininess as an inevitable concomitant of enlarging 16mm. to 35mm. Thus, while enlargements from 16mm. black-and-white originals made on either reversal or 16mm. negative film have at times been made in the case of exceptional newsreel subjects, the fact that the enlarged print retained and magnified the grain-structure of the original 16mm. black-and-white silver image restricted the use of 16mm.-to-35mm. enlargements to strictly emergency subjects in which the news value of subject or action outweighed considerations of photographic quality.

Lack of Granularity

But in working from a Kodachrome original, this is not the case. Grain-size, for all practical purposes, simply does not enter into consideration. The original 16mm. Kodachrome is virtually grainless, for the image is formed not of an aggregation of minute silver particles but of virtually homogeneous deposits of chemical dyes. Therefore, there is literally no grain to be rephotographed and magnified in the enlarging process.

The results on the screen, therefore, are as grainless as direct 35mm. Technicolor prints. The writer took pains to inspect some of these enlargements from a point within a few feet of the screen—far closer than is possible in any theatre or auditorium. No graininess was apparent, though from the same viewing distance even a fine-grain black-and-white 35mm. scene would become a mass of bewildering grain. It can safely be said that these enlarged color-prints will not appear grainy even from the front-row seats in a large theatre.

Proof of the lack of granularity in 35mm. enlargements from 16mm. Kodachrome may be found in recalling the scenes of the collapse of the Tacoma bridge released by the major newsreels last year. The greater part of this, the most sensational newsreel "story" of 1940, was captured by an amateur using 16mm. Kodachrome and enlarged to 35mm. black-and-white. It will be recalled that the photographic quality—and especially the grain-size—of these scenes compared excellently with the direct 35mm. scenes with which they were intercut.

Magnetic Recording and Reproduction

BY A MEMBER OF THE TECHNICAL STAFF, BELL TELEPHONE LABORATORIES

FOR many years communications engineers have been experimenting with sound recording, because it is a most useful tool in studying the characteristics of speech. Reproducibility of a recorded sound, and its permanency, make possible detailed analysis of a particular word or phrase. There are three methods of recording sound: *mechanically* on wax, *photographically* on film, and *magnetically* on a steel wire or tape.

The first method has found wide commercial application in phonographs and the second in sound motion pictures; but the third has until recently been used only in experimental apparatus. Recent developments, however, have made it a practical means of high-quality sound recording and reproducing.

These new developments have been incorporated in the Western Electric "Mirrophone." It handles higher frequencies than previous magnetic sound recorders and is freer from distortions. These improvements largely account for its faithful reproduction of speech and music.

That sound could be recorded on a steel wire drawn at a uniform rate past the poles of an electromagnet, which carried voice currents from a microphone, was discovered by Poulsen, a Danish physicist, about forty years ago. This method has the advantage that the records are ready for immediate reproduction, since no processing is required as with sound recordings on wax or film. Moreover, recordings can be retained practically indefinitely without appreciable deterioration; but if wanted only temporarily, they can be erased and used immediately for other records.

New Magnetic Materials, Tape

Attempts to commercialize the magnetic method of sound recording met with little success, however, until the improvements of recent years in which Bell Laboratories have been largely concerned. These improvements include the use of better magnetic materials and thin, narrow tape instead of round wire. Round wire twists and the magnetic elements have to be recorded along it instead of transversely across so as to maintain in reproduction the same direction of polarity. This result was achieved by offsetting the pole pieces of the recording magnets along the wire.

The highest frequency that could be reproduced depended on the length of the longitudinal magnetic elements and high wire speeds were necessary to obtain faithful reproduction by this method. These high speeds not only required long recording wires but they wore the pole pieces excessively.

Flat tape does not twist, and this permits magnetizing the recording medium transversely instead of lengthwise. The magnetic elements can then be shorter and this allows the speed of the tape to be reduced without losing the higher frequencies in the recording sounds.

Before a magnetic record is made, the tape is strongly magnetized in a direction opposite to that produced by the recording magnet. It is then partially demagnetized by a direct biasing current, which is applied through the recording magnet to condition the tape so that the record will not be distorted.

The reason for this procedure can be explained by referring to the magnetization curve in Fig. 1 which shows the intensity of magnetization of a typical magnetic material plotted against the corresponding magnetizing force, which is proportional to the microphone currents. When the tape is between the poles of the polarizing magnet it is brought to magnetic saturation as indicated by the flattening of the curve at P in *Fig.* 1. As the tape passes beyond the pole pieces its magnetism decreases along curve B to R, which shows its residual magnetism when the magnetizing force has been reduced to zero.

A biasing winding on the recording magnet reduces the magnetism of the tape still further to N, if there are no voice currents in the recording coil. When the tape leaves the field of the recording magnet, the magnetization follows curve I to O.

If there are voice currents in the recording winding, the magnetic flux varies, as for example between A and C, while the tape is between the pole pieces. The nearly straight portion, AC, of the magnetization curve is thus used for recording because the magnetizing effect is proportional to the magnetizing field, and distortion is effectively eliminated. After the tape passes the recording magnet the flux range AC becomes A'C' as shown in the figure.

Voltages induced during reproduction are proportional to the rate of change of magnetization, hence for a constant tape speed proportional to the frequency of the recorded sound. The response, in other words, increases directly with the frequency. This holds true, however, only at low frequencies. At higher frequencies the response diminishes because of the finite width of the pole pieces and because of hysteresis and eddy current effects. The frequency at which this decrease begins is higher in proportion to the speed of the tape. The response of a magnetic recorder thus rises steadily with the frequency to a maximum determined largely by the design of the pole pieces and the speed of the tape. Beyond that the response decreases progressively. In practice an equalizer is inserted in the circuit to make the response essentially constant for all frequencies.

Functioning of Equipment

These principles of magnetic recording are incorporated in compact practical form in the Mirrophone. Housed in a small cabinet is the recording-reproducing unit, an amplifier and a loud speaker. Associated with this unit there is a high-fidelity crystal microphone. The thin narrow tape on which the recordings are made is mounted on drums, *Fig.* 2, which rotate to draw the tape between the poles of the recording magnet. To allow the tape to repeat without rewinding, its ends are welded together to form an endless belt. The material of the tape is a special mag-

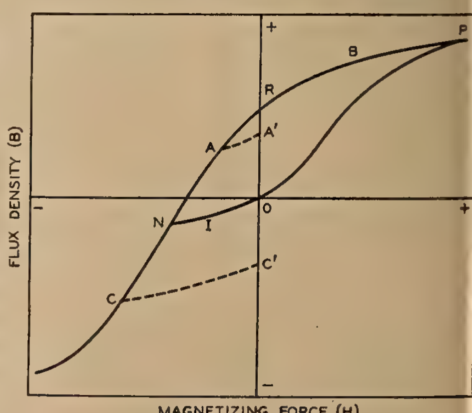


FIGURE 1

To avoid distortion the magnetic record is confined to the nearly straight portion, AC, of the hysteresis loop.

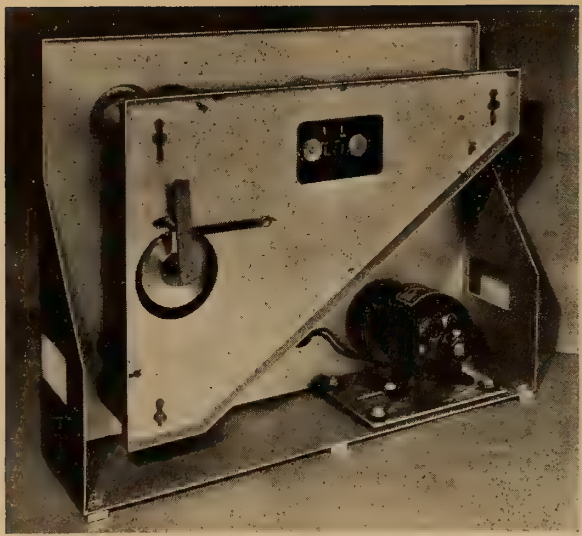


FIGURE 2

The recording tape is held on drums which rotate to pass it between the poles of an electromagnet to which the amplified microphone currents are applied. No rewinding is required because the ends of the tape are welded together.

netic alloy recently developed by the Laboratories which is superior to other materials for magnetic recording.

In reproduction, the recording magnet serves as the device. *Fig.* 3 shows the recording and the polarizing magnets; a short loop of tape illustrates the method of threading. These magnets are a removable unit with plug connections. The dynamic loud speaker is supplied by a two-stage amplifier which develops exceptionally high gain. An acoustic chamber encloses the back of the speaker. Its field coil also serves as a filter in the amplifier plate-circuit.

Alternating current from any 110 to 120-volt lighting circuit operates the Mirrophone. A volume control regulates the intensity of the recording or the reproducing currents; and an electronic volume indicator shows when the level is correct for recording. To indicate the length of the recording there is a moving pointer which makes one complete revolution per minute and can [illegible] at any time.

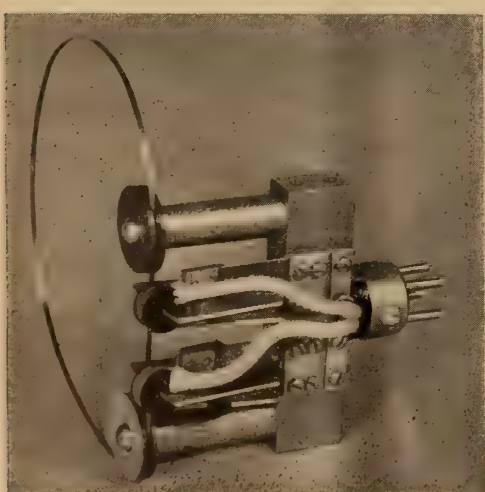


FIGURE 3
The recording - reproducing element comprises two electromagnets. The upper magnet is the polarizing unit; the lower one is that used in recording and reproducing.

A record once made can be reproduced as often as is desired and kept indefinitely or until the switch is again thrown to the recording position. Doing so automatically clears the tape as it passes the polarizing magnet and prepares it for a new record. The switch also has a stand-by position which leaves the tape running but disconnects the erasing, recording and reproducing units. An output jack permits connection to an external loudspeaker or to another recording machine when permanent records are wanted.

Best quality recordings are obtained when the speaker is close to the microphone, but the results are entirely satisfactory from greater distances. Group conversation can be picked up when the speakers are several feet away. Intelligible recordings have been made in large auditoriums with the sound source many feet from the microphone. On the other hand, whispered words can be reproduced loud enough to be heard by all present in a large audience.

A person who hears a recording of his own voice for the first time usually insists that it does not sound natural. His friends, on the other hand, assure him that the reproduction of the Mirrophone is faithful. This is because one's own voice is ordinarily heard not only through the air but also internally by conduction through the bones of the head. Thus its true quality is unfamiliar.

Bleak Outlook For Television During 1942

By ***W. G. R. BAKER***

GENERAL ELECTRIC COMPANY

TELEVISION, as with the other services provided by the radio industry, has suffered from defense. Perhaps television has been retarded more than any other service since it was not so far advanced. No new types of television receivers have been placed on the market, presumably due to the shortage of material, plus the fact that two companies who had previously marketed receivers had to change the sets in the hands of the public and in the distribution channels, to meet the new standards established by the FCC.

There are probably in the channel of distribution and in manufacturers' stocks, a few hundred television receivers. Whether or not after these are sold additional receivers of the same type or of new designs will be produced probably depends upon the materials situation and the decision of the individual manufacturer as to whether it is more desirable to utilize such material as is available for broadcast or television receivers.

It seems apparent that the manufacture and sale of television receivers is one section of the business that might tend to offset some of the anticipated difficulties of the post-war period. If this be true, it would seem desirable to maintain a reasonable amount of activity in television receivers so as to be ready when the time arrives. In addition, it apears evident that unless some steps are taken to increase the number of receivers, the companies operating television transmitters will be faced with a continuing loss that in time may reach such proportions as to justify serious question as to the desirability of holding the license for a television transmitter. Fortunately, the FCC is fully cognizant of this situation and will undoubtedly assist in obtaining an equitable solution.

Present Transmitter Set-Up

The present television transmitter situation is that 8 stations have been granted commercial licenses and 34 stations experimental licenses. One station is operating on a regular commercial basis and fairly regular programs are offered in at least 3 other locations. Eleven of the experimental stations are now operating experimentally.

Due to the new standards adopted by the FCC and to the need for increased studio facilities for commercial type programs, General Electric's television station at Schenectady was modified substantially during the year. The aural transmitter was increased to 20-kilowatt output and changed over to FM, and the two final stages of the visual trans-

mitter were rebuilt to provide an ultimate capability of 40-kilowatt output.

A complete new television studio was built providing greatly improved facilities, including five complete picture channels, each with its own rack of equipment, which, in turn, includes a video amplifier, camera-sweep generator, regulated power supplies, and monitoring equipment. All of these are designed to meet the new rules of the FCC, such as the increase of scanning lines per frame from 441 to 525.

Studio programs are relayed to the main transmitter in the Helderberg Mts. (near Schenectady) and the antennas at the studio used for this purpose are mounted on the top of a 1280-foot steel tower and enclosed in a protective wooden structure to avoid the serious detuning effects of snow and ice.

Program director, technical director, and sound operator in the studio have their respective console in an elevated gallery off the main studio from which they have complete control of all the various picture and sound channels, including the method of changeover between television cameras, which may be a switch, a lap-dissolve, or a fade-out fade-in.

Studio Projection Facilities

In the studio projector room are two 35mm. projectors, each designed to handle 2000 feet of film. Feature-length films may be used as in standard theatre practice by making accurately-timed changeovers between the machines. One 16-mm. projector is also provided for handling amateur and some news films, and there are two still projectors for slides or film strips.

The studio maintenance shop has two Iconoscope cameras mounted on rolling frameworks and provided with flexible

World Premiere of

"FASHION DISCOVERIES OF TELEVISION"

presented by Norman D. Waters in collaboration with

BLOOMINGDALE'S and ABRAHAM & STRAUS
Manhattan Brooklyn

Today between five and five-thirty o'clock over Station WNBT the first sponsored television fashion show will be presented. Not just a model parade but a cleverly devised playlet that makes fashions live. Beautiful manikins, that talk and sing, an announcer who is a well-known authority on women's styles. See it over your own television set or in either store. Watch for it every Thursday at the same time. And we'd like to have you let us know how you like it.

Typical example of promotion effort in behalf of commercial television, in this case an obvious effort to enlist feminine support for an extension of the home-listening front. Tele broadcasts continue, but receiver manufacture has been stopped by the war.

cables leading to the control room on the floor above. Each of these cameras may be placed in position to receive any one of the five pictures from the adjacent projection room.

The new studio building also includes an interview studio, rehearsal room, office space for director and staff, dressing rooms, power switching, air conditioning, compressor and battery rooms, and a property room, making this without doubt the finest television studio layout in the country and one which will be of particular interest to others as television develops a need for its own quarters.

New Relay Repeater

A new relay repeater was completed for the pick-up and retransmission of New York City television programs, thus providing access to a large number of programs of importance and general interest. This constitutes the world's longest television rebroadcast tie-up. Efforts during the year were necessarily devoted to getting the General Electric station ready for regular commercial program service in accordance with the latest FCC regulations, and thus establishing a basis for a line of standard television transmitting apparatus for general sales.

Random Notes

REGARDING the proposed changes in the Standard Release Print proposed by Local Union 150: I believe that this plan was a progressive step in standardization, not only in the theatres but also in the commercial field generally. From the very beginning, however, one important step was either overlooked or disregarded—the negligence of the film exchanges in maintaining SRP specifications.

The work of the various laboratories has, I think, been commendable; but since the exchanges are the link between laboratories and theatres, it is obvious where the fault for non-standard practices lies. Why could not the exchanges set up and *enforce* penalties against any theatre that intentionally alters the SRP.

Under present-day practice, most prints that reach third- or fourth-run theatres have a number of different starting marks. The records show that some prints carry five different starting and cut-over cues. In one particular case a print bore 22 separate marks within 15 consecutive frames used as changeover cues. What did the projectionist do about it? Why, he simply added his own cues.

Fade-Ins a Prime Trouble Source

There will be no cessation of the conflict between projectionists and exchanges until some authoritative body moves to correct present conditions. Why couldn't the Projection Practice Committee of the SMPE undertake this task, acting not as

a policing agency but only as a liasion group?

Projectionists allow themselves about one foot of film on the incoming reel during changeovers as a margin of safety. I have handled a number of reels with very short fade-ins. Consequently, if the changeover was made too soon, a flash of the wide SRP frame line would be shown at the bottom or the top of the screen; and if the changeover was made one second later, the fade-in would be missed. On investigation it was found that the length of the fade-in would be only about 20 frames, which was entirely too short. For this reason, therefore, I propose that fade-ins at the beginning of reels be at least 3 feet in length, or, in other words, that the distance from the end of the SRP to the beginning of the fade-in be at least 20 inches, depending upon the type of fade-in.—FRANK DUDIAK (L. U. 239), *Projectionist, National Archives, Washington, D. C.*

• • •

Here is a handy tube replacement tip applicable to the first stage of any sound system, theatre or portable. In cases where metal 6J7 tubes are used (such as in Simplex pre-amplifiers and in other type main amplifiers) where trouble due to microphonics or hum develops, the RCA-1620 is an excellent tube to use. This is the same tube used in Photophone amplifiers.

In cases where trouble with glass tubes is experienced, the Kenrad 7000 and the 7700 are very good replacements. The 7000 has an 8-pin base and replaces the 6J7G; while the 7700 has a 6-pin base and replaces the 6C6.—J. G. BLACK, *Chicago, Illinois.*

• • •

James L. Craddock, of N. Y. City, harking back to the days when the Vitaphone disc system of sound movies held sway (and he means *sway*) asks that we throw light on the Philco "beam of light" phonograph—and he adds that many more men in the field might welcome such information. Well, here it is, right from the feedbox:

The "beam of light" Philco job introduced (several years ago) entirely new principles in reproducing speech and music from records by giving practical application for this purpose to one of science's greatest achievements—the photoelectric cell. Among the advances thus made possible are a notable improvement in the tone and quality of phonographic reproduction and a claimed increase of 900 per cent in the useful life of records.

The basic idea behind this development was to find means to eliminate the actual, mechanical work formerly done by the needle being dragged through the grooves of the record. The availability of the p.e. cell made it possible to give this idea practical application.

In the "beam of light" phonograph, the needle has been replaced by a sapphire jewel which floats through the grooves on the record, transmitting the tone vibrations to a tiny mirror swinging freely on an axis. A beam of light, produced by a small bulb and directed at this vibrating mirror, picks up the vibrations and reflects them on a p.e. cell. The cell, activated by the vibrating lightbeam, converts these vibrations electrically into music.

Unique Mirror, Lighting Arrangement

The mirror used is as thin as paper, and is made of special glass used in the manufacture of scientific instruments. It has a vaporized aluminum coating similar to that of the new 200-inch telescope.

A steady flow of light for the tiny bulb shining on the mirror is provided by an oscillator which transforms ordinary 60-cycle A.C. house current into high-frequency current of 1,800,000 cycles. The bulb itself had to be especially designed in order to be sufficiently small and light weight. No flashlight bulb was strong enough for the purpose. The one used in the p.e. phonograph is filled with argon in order to provide a bright light and still not burn out quickly.

Because a freely-flowing sapphire jewel has replaced the steel to detect what is on the record, wear and tear are reduced to a minimum and gouging and fraying

of the record are virtually eliminated. The jewel has a life of from 8 to 10 years.

A NEW EASTMAN KODACOLOR FILM FOR ALL CAMERAS

DEVELOPMENT of a process in photography which will enable any amateur with an ordinary camera to obtain full color prints instead of blacks and whites from his negatives was described before the Franklin Institute recently by Dr. C. E. K. Mees, director of research and development for Eastman Kodak Co.

The company will market about Jan. 15 a color roll film in six popular sizes. From the roll, colored negatives will be processed in the hues of the objects depicted. The negatives, when printed on a new emulsion, will yield a color print in the shades of the original object.

The company called the new process "the greatest achievement in photography since George Eastman pioneered and introduced the first black-and-white roll film in 1889."

All prints from any size camera will be 2⅞ inches in width but will vary in depth from 4 to 5 inches. A roll of Kodacolar film for a camera of 120 size (2¼x3¼ inches), and containing six exposures, for example, will retail at $1.50. The price will include the processing of the negatives. Prints will cost 40 cents each, bringing the total price for such a roll of film, with six positives, to $3.90, or 65 cents a print.

Kodacolor was made possible, by the development of a process in which the couplers (chemical agents which serve to bring together the blue, red and green emulsions in the proper blends upon development of the film), were contained in the emulsion layers, not dissolved in the gelatin layer itself.

Description of the Process

"The couplers are dissolved in very small particles of organic materials which protect them from the gelatin, and, at the same time, protect the silver bromide until the film is immersed in the developer. Then the oxidized developer penetrates the particles and there reacts with the coupler and forms the dye inside the particles suspended in the emulsion.

"This process has now been perfected and introduced to the public under the name of kodacolor. The film is developed by Kodak to give a complementary negative, from which prints on paper will be made by the same process. The name Kodacolor was used some years ago by Kodak for an entirely different additive process of color photography used for the first amateur color movies, a process which is obsolete.

"The film is coated with the three light-sensitive layers as well as a yellow filter layer. In each of the emulsion layers are suspended particles of organic compounds insoluble in water, so small that they can be seen only under a high-power microscope, and these particles contain the couplers required to produce the dye appropriate to each layer when they react with the oxidized developer.

The Processing After Exposure

"After exposure the film is processed with a developer of which the oxidation product will react simultaneously with all three couplers and thus produce a dye image along with the silver image in each layer. After the silver has been removed, a negative is obtained composed of dyes, in which the image is not only negative as regards light and shade but in which all the colors are complementary to those of the original subject.

"Thus, the blue sky appears yellow in the negative, the red lips of a girl are blue-green, and a bright blue dress becomes

orange. When such a negative is printed upon a paper coated with a similar set of emulsions, a color print is obtained in which the colors of the original subject are reproduced."

GIVE BOOKS FOR THE BOYS

Books by the million will change hands in the National Defense Book Campaign starting January 12, 1942, when readers in homes throughout the land will share the books they have enjoyed with our armed forces.

The campaign seeks ten million books for U.S.O. houses, Army "dayrooms," ships, Naval bases, etc. Books should be taken to libraries, where they will be sorted, repaired if necessary, and sent on as quickly as possible to the spots where men in the service want books. In many communities schools and other conveniently located places will be designated as collection centers. Unbound magazines and newspapers will not be handled.

Put your name and address in the books you give: the boys will be so interested to know "who gave what"!

THE MECHANISM OF SEEING

(*Continued from page* 16)

between the old and new fields of view.

These processes, named in the order described, are, respectively, convergence, fixation, and accommodation. As mentioned previously, they take place automatically without conscious effort when the eyes and seeing conditions are both normal.

If the visual apparatus is not normal, several situations may occur: (a) the defect is not great enough to prevent clear vision, which, however, is achieved at the expense of unusual effort and of nervous and muscular tension; (b) the defect is great enough to prevent adequately clear vision and a continuous process of adjustment and readjustment takes place, resulting in eyestrain and fatigue; (c) when the effort of adjustment becomes excessive, a complete breakdown in response may occur. Astigmatism is a good example of cases (b) merging into case (c). One noted authority[1], speaking of astigmatism, says:

"Regular astigmatism, the only form which permits of optical correction, invariably produces greater or less defect in visual acuity. It is particularly liable to cause the worst forms of asthenopia or eyestrain; the asthenopia in these cases is only in part accommodative. It is often worse in the lower degrees of astigmatism than in the higher. This is probably due to the eye endeavoring so to accommodate as to produce a circle of least diffusion upon the retina. Aching of the eyes, severe headaches, and typical migraine are complained of; the eyes quickly become fatigued with reading, and the letters are described as running together."

This opinion is of interest because it, together with the preceding description, enables us to formulate the following general principle concerning visual effort: Whenever the visual mechanism is called upon to concentrate its attention upon some specific detail or sequence of details within its field of vision, it responds with a number of automatic adjustments; the purpose of which is to produce a clear and centrally located image of these details on the retina.

Any factor which increases the diffi-

[1] Sir John Herbert Parsons: "Diseases of the Eye." 8th Edition, The Macmillan Company, New York, 1936.

culty of attainment of this clear image imposes an unnecessary strain on the visual mechanism which attempts to overcome the difficulty by a continuous process of readjustment. Certainly in many, and quite possibly in all such cases, this mechanism receives conflicting demands with respect to the type and degree of adjustment to be made.

As the difficulty of adjustment increases so do the resultant eyestrain and fatigue. This is true up to the point where the difficulty of adjustment becomes so great that one set or the other is eliminated. This latter statement explains why low degrees of astigmatism often produce worse forms of asthenopia or eyestrain than do the higher.

Some Physical Factors

Light radiated or reflected from any object which we see is brought to a focus at or near the retina by the transparent portions of the eye. The automatic adjustments described previously are for the purpose of centering the image, controlling the amount of light in the image and (by changing the curvature of the crystalline lens) focusing the image on the retina. Innumerable sense endings in the retina pick up differences in brightness or color in the image and, by means of nerve systems, transmit a record of these differences to the brain in the form of nerve impulses which are there interpreted. The sensitivity of the sense endings varies with the total amount of light which the pupil allows to enter the eye.

If the difference in brightness of the different parts of the image on the retina are kept in the same relative proportion to each other but the overall brightness of the image is increased, the eye can detect these differences in brightness with greater ease. This increase in sensitvity may be obtained either by increasing the size of the pupil which lets in more light or by increasing the brightness of the object by, for example, increasing the illumination.

Unfortunately, no optical system is perfect. This is particularly true of the lens system of the eye, and the wider the opening of the pupil the less sharp are the outlines of the image. Therefore when we wish to see fine detail in an object the pupil should be decreased in size.

We need one more fact before applying our principle to a specific case. When the brightness of all the field of vision is low, the pupil is large. With increasing brightness the pupil closes up until a limiting value is reached beyond which no further decrease in size can take place.

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NOVEMBER 1941

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Monthly Chat

NOT in a spirit of gloating but rather with a feeling of deep satisfaction do we record the fact that after forty years of strenuous effort on the part of the projectionist craft, with a bit of help from its few friends outside the ranks, the motion picture industry—and we except no branch thereof—has become acutely projection-conscious. That it required a national emergency to accomplish this end detracts not one whit from the significance of this immense gain in prestige scored by the craft.

The reason for this abrupt change in attitude on the part of the industry is twofold: (1) priorities on almost every conceivable unit of projection equipment, and (2) the sudden realization that in the event of an emergency—an "alert" or an actual air raid—the projectionist is in a key position not only to avert a catastrophe (panic on the part of a theatre audience) but to otherwise contribute greatly to the entertainment and relaxation of a large segment of the American people—a tremendous contribution to the maintenance of morale.

This responsibility for the entertainment and safety of the public, of course, has always been recognized by the projectionist craft, and the present emergency serves only to heighten its appreciation of its responsibility and strengthen its resolve to prevent any letdown in either direction. But now this function of the craft will have not only the active cooperation but also the respect and admiration for a job well done of the industry as a whole.

That which needs to be set down here is that the craft must exert every effort to justify this confidence that has been placed in it. Whether it be a matter of normal projection routine (and here, too, there is great need for the exercise of greater care and competency) or whether it relate to the larger aspect of the job in conserving electric current and preserving materials and equipment, the craft must not only not shirk but must give to the utmost of its resources.

From the studios down on through the distributors, exchanges and exhibitors, and particularly the equipment manufacturers, the eyes of the industry are turned expectantly toward the projectionist.

Now it is that general industry recognition has been gained for the fact that, after all, that which counts most is what "hits the sheet", the entertainment on the screen. The physical condition of the theatre plant may deteriorate, patrons' comforts may have to be neglected, but the final answer as to the degree of success achieved by the industry in serving the public will be written in terms of what is on the picture screen and with what degree of skill that entertainment is presented.

Here is a golden opportunity for the craft to take a firm grip upon the industry's respect, never to loosen its hold.

INTERNATIONAL PROJECTIONIST

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Object Lesson in Power Conservation

By *CHARLES W. BUTLER*
PROJECTIONIST, NEW YORK CITY

OPERATING policies instituted and rigorously adhered to by the so-called chain theatres have been responsible for much of the success of the modern motion picture theatre, particularly with regard to their physical operation. Still, the independent exhibitor refuses to acknowledge this fact by either ignoring completely or adopting only partially those practices which have been so successful for the chain houses. This stubborness on the part of independent exhibitors not infrequently means the difference between "black" and "red" operation.

One aspect of exhibition illustrates very well this shortcoming on the part of the independents. All exhibitors understand the meaning of the word "demand" as applied to seating capacity. If 2000 persons must be accommodated at any one time, this is provided for when the house is constructed; or, in some cases, by a remodelling job. All seats are not always in use, of course, but their availability—represented by capital investment, space rental, and maintenance—is a form of "demand" charge.

Now, electric power companies also must provide for similar "demand" service. Utilities are confronted with the same problem of initial investment, station and distribution facilities, availability of capacity, maintenance, and costs of lines and related equipment in order to provide service on "demand"—which means when it is needed, day or night.

In most cities the utility companies install "demand" meters in addition to the regular kilowatt-hour meters; in other cities there is a flat-rate charge. The demand meter indicates the highest power demand of 30 minutes duration in any half-hour period, generally within 30 days elapsed time. Considering all factors involved, the demand charge basis seems reasonable. Like all similar services, unless there is a careful check of the electrical energy consumed, a theatre can waste plenty on a demand basis.

Acute Power Shortage

Generally, theatre circuits have tests and surveys made to ascertain just what demand will be required. In addition, they buy equipment that is dependable and which over a period of years will show a net saving without any sacrifice in operating efficiency.

During the present war period, with a shortage of electrical energy a real threat to continued theatre operation, it might be advisable for projectionists to discuss with the management of their respective theatres the wisdom of effecting savings by all reasonable and practical solutions. Such thoughtfulness on the part of projectionists may forestall requests for salary reductions, not to mention a possible decrease in theatre operating schedules stemming from either blackout orders or power conservation needs.

One of the first considerations should be the energy wasted by operation of Suprex arcs from D. C. mains at either 120 or 240 volts, because of the tremendous loss in the ballast rheostats which is dissipated in the form of heat. Not only is this loss great in itself, but operating results with the Suprex arc are not as satisfactory on a 120-volt D. C. line as with a generator of the próper voltage and characteristics. Use of 240-volt D. C. service is impractical. Yet, it is surprising how very many theatres in the D. C. districts of some cities continue to use such service.

About a year ago there was installed in an uptown N. Y. City theatre an excellent make of motor-generator set for a trial period. The projectionists were glad to have this unit because they knew that it was more economical and would

give better results. Moreover, the Suprex arc did not function as well on the 120-volt D. C. source as it should have.

This particular theatre has both A. C. and D. C. services, which are bought on a wholesale basis and distributed to various stores in the building, as well as to the theatre. The allocation of charges is a rather complicated matter, but competent accounting might have supplied the reason for the final decision anent the efficiency of motor-generator set.

The power company demand charge was terrific for both the A. C. and D. C. services. With the installation of the generator, of course, the A. C. demand would have been higher; however, the D. C. demand could have been eliminated and the A. C. increase held to nominal limits, as is indicated in the accompanying tables, which show a pronounced difference in favor of the generator.

Despite the straightforward story told by the accompanying tables, this theatre is now back on regular Edison Company service because, according to the exhibitor, the generator "did not save enough." One need not be an electrical engineer to make an intelligent comparison of the figures in the tables and thus prove Mr. Exhibitor conclusively wrong. While it is true that the generator under discussion was of high quality, comparable values were obtainable with any other good set.

The cost of the generator with ballast resistors was not stated at the time of installation for the test. However, it is known that it would cost less than $800 and could have been purchased on a deferred-payment plan. There is some reason for suspicion that the exhibitor hoped to buy the set at actual dealer's cost; failing this, he was too poor a businessman to have someone determine the facts and be paid for the survey.

It is apparent that the use of 220/240 volts D. C. service would multiply all losses tremendously. A 65-ampere load on a 220-volt line (186-volt drop x 65) would show 12.09 kilowatts of energy wasted in the ballast resistor; on a 240-volt line there would be a waste of 13.39 k. w.

Certain other economies could be made in the theatre to reduce the demand peak loads and thus lower the regular charge. Light in the sign and marquees which burn more or less continuously could be replaced by either a new design or with flourescent lighting, therefore effecting a great reduction in operating cost. A comprehensive survey of the entire theatre should be made for the purpose of determining if the lamp wattage or the type of lighting can be changed economically.

For the purposes of this presentation, the accompanying tables tell the story.

It must be remembered that a motor-generator set having two separate elements is not affected by A. C. line variation, and provides direct current that gives a brighter arc and relieves the projectionist of worry in connection with the maintenance of the power supply.

Comparative Costs Tables for Electrical Energy

Service for Suprex Arcs: 34-Volt, 65-Amperes, 8 mm. x 7 mm. Carbons

Edison Co. D. C. Line	*Volts*	*Amps.*	*K.W.*
D. C. Line	120	65	7.80
Ballast (LOSS)	86	65	5.59
Arc	34	65	2.21
Efficiency Overall, Line to Arc		28.34%	
Loss " " " "		71.66%	(Ballast)

60-Volt, 65-130 Amp., 10-H.P., 220-Volt, 3-Phase, 60-Cy., Multiple M.G.

A. C. Line 220-Volt	3 Phase	10 H.P.	5.25 (Actual Test)
Gen. D. C. Line	60	65	3.90
Ballast	26	65	1.69
Arc	34	65	2.21
Efficiency Overall A. C. Line to arc	42.09%		
Loss " " " " " "	57.91%		
Overall Efficiency, M-G Set only	74.28%		

Consolidated Edison Co.

Monthly Demand: Based on greatest 30-minute demand in any ½ hour period, as registered during the month.

Demand:	First 3 K. W.	(Included in Energy Charge)	
	Next 12 K. W.	$2.50 K. W.	Monthly
	Next 12 K. W.	2.00 K. W.	"
	Next 1000 K. W.	1.75 K. W.	"
	Next 2000 K. W.	1.50 K. W.	"

If the theatre is using 50-60 K. W. demand, the rate would fall within the $2 bracket. Energy rate is calculated at approximately 5¢ a kilowatt hour.

	Demand K.W.	*Hourly K.W.*	*Daily K.W. 10 Hrs.*	*Kilowatts Consumed (30 Days)*	*Energy Charge .05c KWH*	*Demand Charge $2.00*	*Total Costs*
D. C. Line	7.80	7.80	78.00	2340	$117.00	$15.60	$132.60
A. C. Line*	5.25	5.25	52.50	1575	78.75	10.50	89.25
Differential	2.55	2.55	25.50	765	38.25	5.10	43.35

* 60-volt, 65-130 ampere, 10-h.p. 220-volt, 3-phase, 60-cycle M-G set. $43.35 monthly; over a period of 12 months: $520.20—which would soon pay for the M-G Set.

LIVING COSTS IN BASIC NEEDS RISE 11% WITHIN YEAR

Living costs of moderate-income families in October, 1941, averaged about 11 percent higher than in August, 1939, the month before the outbreak of war in Europe. Most of this increase in the cost of living of wage earners and clerical workers has been recorded since the beginning of the year.

Between the middle of September and the middle of October the Bureau of Labor Statistics cost of living index for large cities registered a rise of 1.2 percent. Food costs, which increased sharply in the preceding month, continued to advance, although at a considerably slower pace. Flour, bread, milk, eggs, oranges, coffee, and lard were among the important foods for which higher prices were reported. These increases were offset in part, however, by seasonal declines in meat prices.

Although the major part of the increase in costs of fall clothing was recorded last month, further increases in the retail price of many articles of clothing were reported in October.

RCA-DUMONT CROSS-LICENSING

The consummation of patent license agreements between RCA and the Allen B. Du Mont Labs., Inc., has been announced. The Du Mont organization is thereby licensed under standard RCA patent license agreements; while Du Mont in turn grants RCA a non-exclusive, non-transferable license under all Du Mont patents covering important advances and refinements in cathode-ray oscillography and in television transmission and reception.

Some Improved Methods of Controlling Carbon Arc Position†

By *D. J. ZAFFARANO, W. W. LOZIER* and *D. B. JOY*
MEMBERS OF THE RESEARCH STAFF, NATIONAL CARBON COMPANY, INC.

This article shows, both from previous data and fundamental considerations, the close control of carbon position necessary to obtain constant light on the projection screen, particularly with reflector-type high-intensity carbon arc lamps. Review of the characteristics of this type of lamp and optical system reveals that in order to obtain constant light on the screen it is necessary to avoid variation of carbon position and changes in arc current due to line-voltage fluctuations. Methods of arc control employing photoelectric cells and bimetallic thermostats directly responsive to carbon position have been analyzed with regard to their applicability for this purpose. Some examples of these have been constructed and have demonstrated that automatic devices of simple construction are capable of maintaining constant the intensity, distribution, and color of the light on the projection screen.

RECENT years have seen great advances in the carbon arc light-sources used for motion picture projection. The Suprex type of arc and the more recent One Kilowatt arcs have brought to both the medium and small-size theatres much-needed increases in screen brightness, a more favorable color quality, and improvement in efficiency. The fundamental factors important to the operation of these reflector-type high-intensity arc lamps have already been described.

One of the important requirements for uniform light is the fact that the arc must be accurately maintained at the proper distance from the reflector. The purpose of this article is to show how automatic devices can be employed with these lamps to position the arc and deliver a more constant light to the screen.

The necessity of accurate positioning of the arc is made clear by examination of the geometry of the optical system of the reflector type lamp. Fig. 1 (A) shows the essentials of the optical system commonly employed. The light-source and the film aperture are placed at the two foci F and F' of the elliptical reflector, which gathers the light from the crater of the positive carbon and directs it to the film aperture, which in turn is imaged on the screen by the projection lens. Fig. 1(A) shows the path of a ray from one focal point, F, to the margin of the mirror and to the center of the aperture, F'.

It can be seen that if the crater of the positive carbon is positioned at Q, the light from the center of the crater is focused at the center of the film aperture. If the positive carbon is moved ahead to position P, the ray travelling to the center of the aperture originates from the cooler portion of the carbon back of the crater, which results in a change in color and intensity of the light at the center of the aperture and projection screen. Similarly, if the carbon recedes to position R, the ray travelling to F' originates from the arc stream in front of the crater, which is blue in color.

Fig. 1(B) shows the movement A of the light-source of diameter D within which the ray passing to the center of the film aperture F' will originate on the light-source. The two quantities A and D are related to the angle C by the equation:

$$\tan C = \frac{D}{A} \qquad (1)$$

With lamp and carbon combinations in use today, angle C may be as great as 70 to 75 degrees, for which the tangent is approximately three, indicating from equation 1 that the movement A would be about one-third the useful diameter D of the light-source. The useful diameter of the light-source in some examples may be as small as 0.15 inch, in which

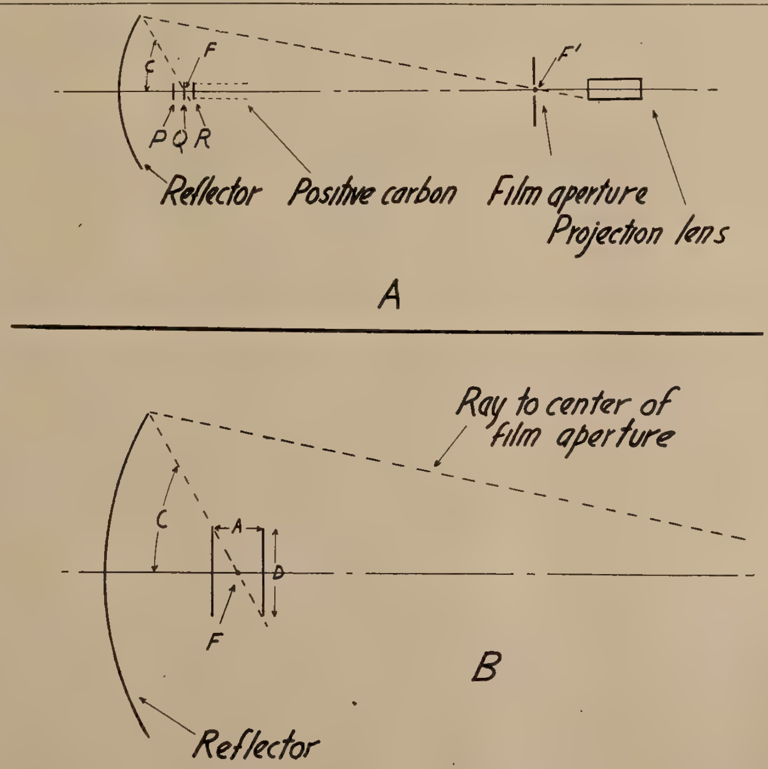


FIG. 1(A). ***Optical system of reflector-type projection lamp, showing relation of position of positive carbon to the light-ray travelling to the center of the film aperture. 1(B). Showing movement A within which light-ray to center of film aperture will originate on light-source of diameter D.***

† J. Soc. Mot. Pict. Eng., November, 1941.

case equation 1 would indicate a movement A of 0.05 inch.

Although the basic considerations used in deriving equation 1 are greatly simplified compared with those that actually exist, the values calculated for the movement A roughly agree with laboratory determinations of the allowable arc movement for satisfactory screen color, especially with carbons burned at low current-densities, where the light-source has limited depth.

Equation 1 suggests that the allowable arc movement can be increased by limiting the collecting angle C to a smaller value and by increasing the diameter of the light-source. Combinations of these two factors can be chosen so that there is no decrease in speed or relative aperture of the optical system and therefore no loss in light on this account. Under these circumstances greater allowable arc movement is observed. Examples are the condenser-type high-intensity lamp and some of the earlier low-intensity reflector arc lamps.

However, the smaller collecting angle results in incomplete utilization of the available cone of light, and the increase in light-source size necessitates larger carbons and higher currents to cover the film aperture and maintain the same brilliancy and light on the screen. Both these result in an undesirable reduction of efficiency.

Even within the range of allowable movement of the positive carbon for satisfactory screen color, there are changes in total screen light and in the distribution of light over the screen. The relations between screen light, screen distribution, arc length, current, and arc position have been previously published and are reproduced in Figs. 2, 3, and 4.

Figure 2 shows the variation in total screen light and distribution with change in the arc position, at constant arc length and current, for one of the popular Suprex-type reflector lamp combinations. This clearly indicates that to hold the variation in screen intenstiy to a few per cent would require that the arc position be held within 0.01 to 0.02 inch.

The foregoing discussion shows the necessity for accurate positioning of the arc. The degree to which this is accomplished with most of the present lamps depends to a large extent upon a favorable combination of the stability of the power source, the speed characteristics of the electrical feeding motor, the uniformity of burning characteristics of the carbons, and the attentiveness of the projectionist.

When it is realized that high-intensity reflector lamps may consume from 2 to 4 inches of positive carbon during a 20-minute reel, and that a movement of the crater position of 0.01 inch would amount to only ¼ to ½ per cent of the total length of carbon consumed, it can be seen that this degree of control is probably beyond the capabilities of any control system except one that is directly responsive to the position of the positive carbon.

Automatic methods of arc control responsive to the position of the carbons offer practicable means of holding the light on the screen constant and maintaining optimum burning conditions at all times. Some of what will be described in this paper is not new. Patents exist covering various embodiments of controls, and to insure freedom from infringement in adopting arc controls for specific lamp apparatus, the active patent arc on the subject should be examined.

Automatic devices responsive to carbon position have been employed to a limited extent with condenser-type projection lamps and to a greater extent on searchlights. They have not, however, found appreciable usage as yet on reflector-type projection lamps.

Constant Screen Light

Figures 2, 3, and 4, giving the fundamental characteristics of high-intensity reflector lamps, point out essential requirements for constant light on the screen. As already discussed, Fig. 2 shows that movement of the arc position greatly changes both the intensity and the distribution of the screen light. Fig. 3 demonstrates that an increase in arc current increases the screen light. Fig. 4 shows that the arc length may be varied considerably without affecting screen light so long as the arc current and positive crater position are held constant.

Fixing the positions of both the positive crater and the tip of the negative carbon with respect to the reflector will result in constant light on the screen, if all other conditions of the arc remain constant. However, with some types of power supply, line-voltage changes produce corresponding changes in arc current which, as shown in Fig. 3, would result in changes in screen light even when the positions of both carbons are fixed.

Where changes in power supply do occur, their effect upon the screen light can be avoided through the use of a method of arc control in which the position of the positive crater is fixed and the negative carbon position is controlled by a current-responsive device that changes the arc length so as to keep the current constant. This latter method

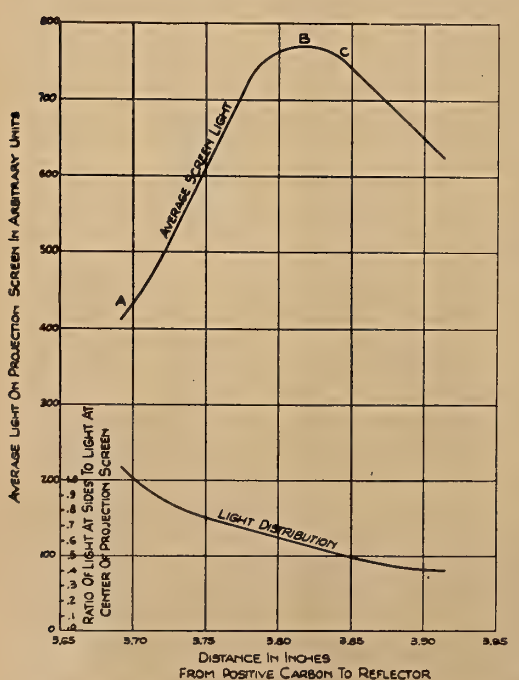
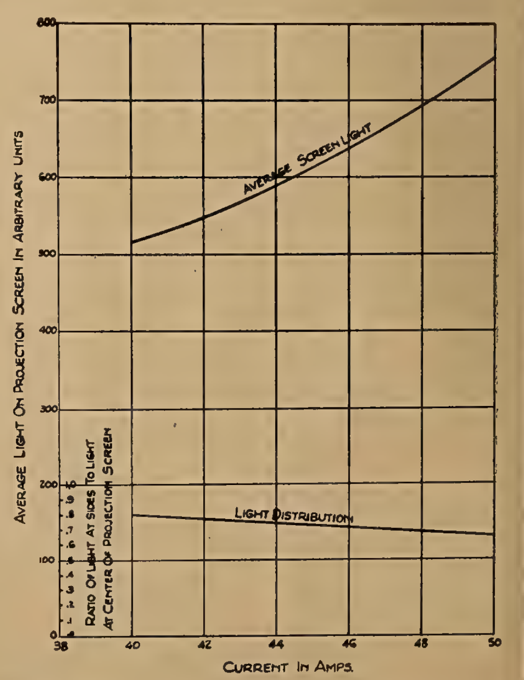


FIGURE 2

(Left) Light on projection screen vs. position of arc: 7-mm positive, 6-mm negative carbons; 45 amperes; 5/16-inch arc length.

FIGURE 3

(Right) Light on projection screen vs. current: 7-mm positive, 6-mm negative carbons; 5/16-inch arc length; positive carbon 3.76 inches from reflector.



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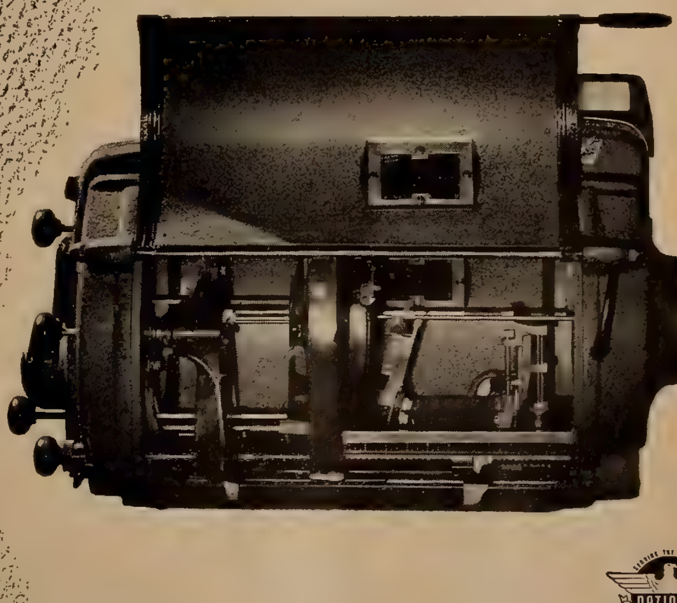
pictures are dim, flat and lacking in color beauty. The tremendous possibilities of the film are there, you have paid for them, but you are not "cashing in".

Ask about this low-cost, one-kilowatt projection lamp which has been designed for moderate sized theatres with screens up to 18 feet in width. See it demonstrated in your own theatre. See how it *doubles* your screen brilliance as against the dim, yellow light of your old low intensities. See how beautiful colorea pictures really are when projected with snow-white light. See how little it affects overall operating costs, but how importantly it affects the box office. Thousands know the name Simplex to be a guarantee that you get the best. Resolve today to have better grosses by having better projection than your competitors.



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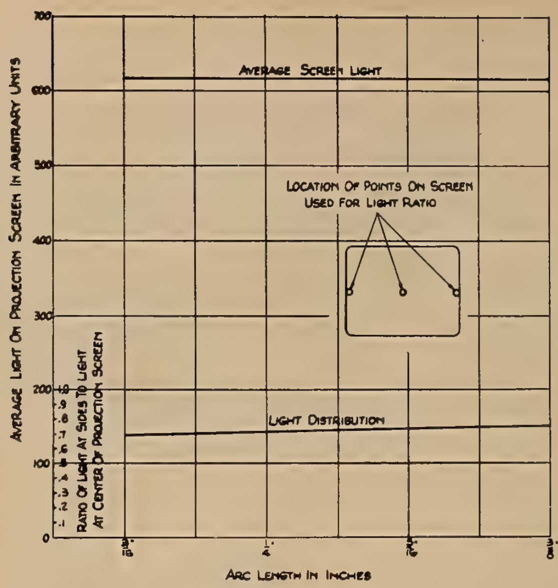


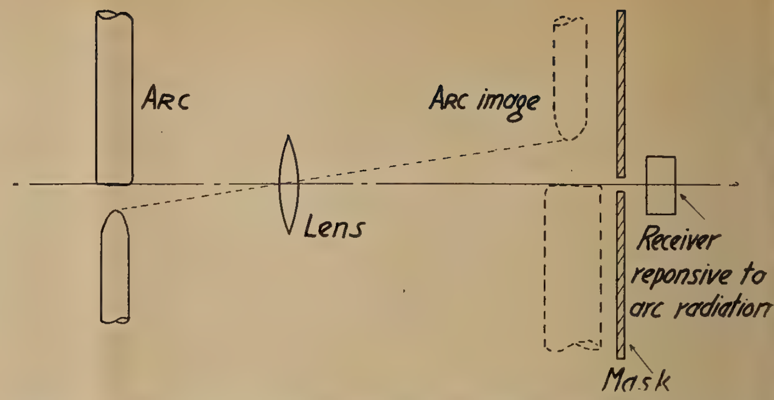


FIG. 5. *Optical system for arc controls; arc image focused on receiver.*

is particularly effective with the low-voltage power sources commonly employed with Suprex and One Kilowatt D. C. arcs with which small changes in arc length result in relatively large changes in arc current.

One approach to the problem of controlling the positions of the burning electrodes in the arc is to use the intense radiation emitted by the arc to actuate sensitive receivers. Such devices include photoelectric cells, which convert radiation directly into electrical energy; or thermocouples, resistance thermometers, and thermostats, which function indirectly through conversion of the radiation into heat.

A simple method of using this radiant energy for arc control is to project a side image of the arc by a fixed lens as shown in Fig. 5. As the arc moves, the image will also move, and a fixed receiver at the image will be subjected to changes in radiation intensity as a direct result of the displacement of the burning electrodes.

The relative intensity of radiant energy emitted along the axis XX' (Fig. 6) of the arc as detected by a thermopile and galvanometer is plotted in Curve *A* of Fig. 6, where the various features can be correlated with the portions of the arc from which they originate. The intensity of emitted radiant energy exhibits maxima at both the positive and negative electrode tips and decreases rapidly a short distance away. The intensity at the positive carbon tip is about three times as great as at the negative tip.

Variation of the arc current results principally in changes in the intensity along the arc stream but does not destroy the essential features shown in Fig. 6 or result in much displacement of the positions of the maxima. The visual appearance of the arc reveals at a glance that the spectral energy distribution of the radiation originating from the various portions of the arc varies markedly.

FIGURE 4

Light on screen vs. arc length: 7-mm positive, 6-mm negative carbons; positive carbon 3.76 inches from reflector; constant current, 45 amperes.

This is further borne out by the Curve *B* in Fig. 6, obtained after passing the radiation through a 5-mm thickness of Corning No. 254 infrared-transmitting filter which absorbs the visible light. This shows that the arc stream is rich in visible light, while the incandescent carbons are relatively richer in infrared radiation. By means of this filter, the radiant energy gradient between the positive carbon and the arc stream can be made much more abrupt.

There are further marked differences in the radiation within the visible wavelengths originating from the different portions of the arc, though these are not illustrated by the energy measurements of Fig. 6. How the marked change in

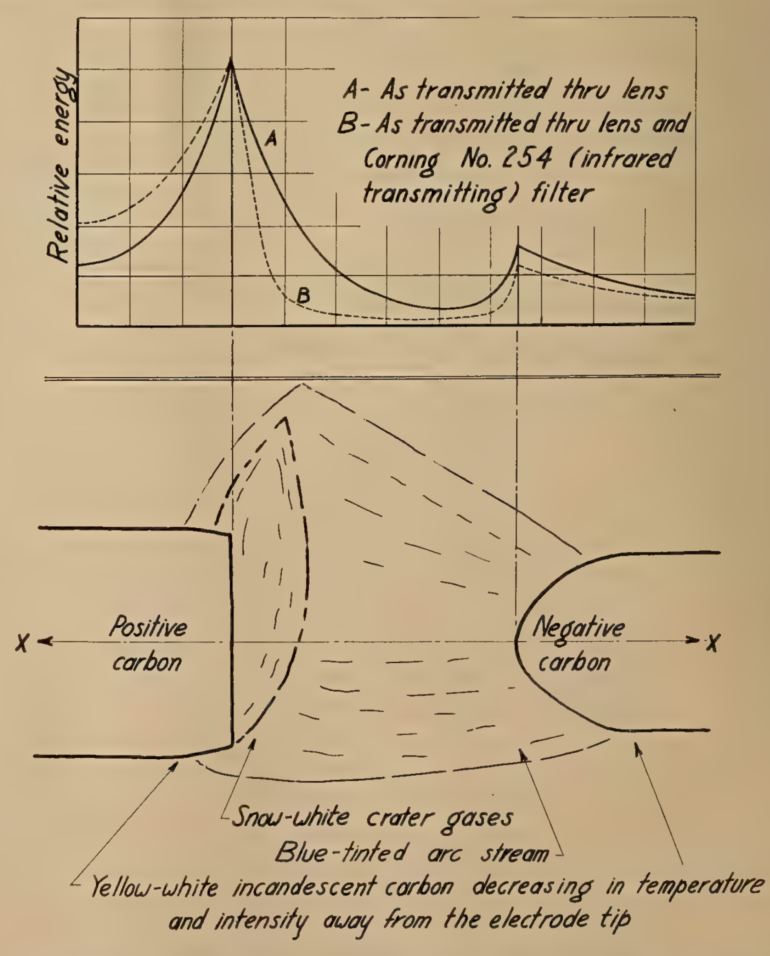


FIGURE 6. ***Image of arc and distribution of intensity of radiant energy across carbons and arc stream. The ordinates of Curve B would need to be reduced by a factor of 2.5 to express them in correct proportion relative to Curve A.***

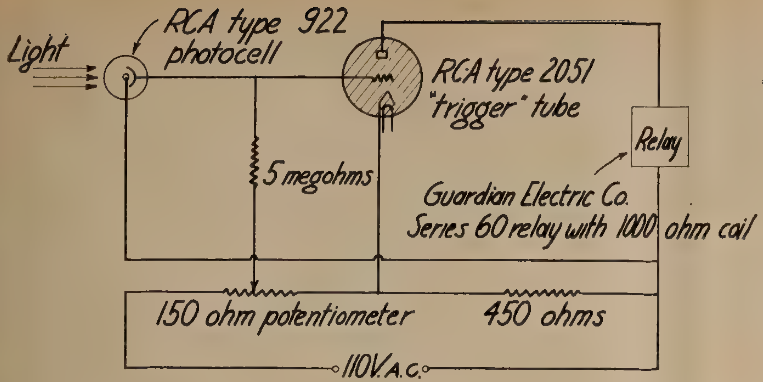


FIGURE 7
Circuit of photocell and amplifier.

energy along the carbons and arc stream can be used to operate arc control devices will be explained.

Arc Control With P. E. Cells

A vacuum-type photoelectric cell was used as a receiver behind a slit ¼ inch wide at an enlarged arc image, as shown in Fig. 5, and was made to operate a relay through an electronic amplifier in response to changes in the light-intensity associated with movement of the arc and its image.

With the arc burning, the amplifier was biased so that the relay was inoperative when the light from the positive carbon just behind the crater struck the photocell. The lamp-feeding motor was adjusted to advance the carbons at a rate slower than their consumption rate, and was connected to the photocell-actuated relay so that it would run at high speed when the relay was energized.

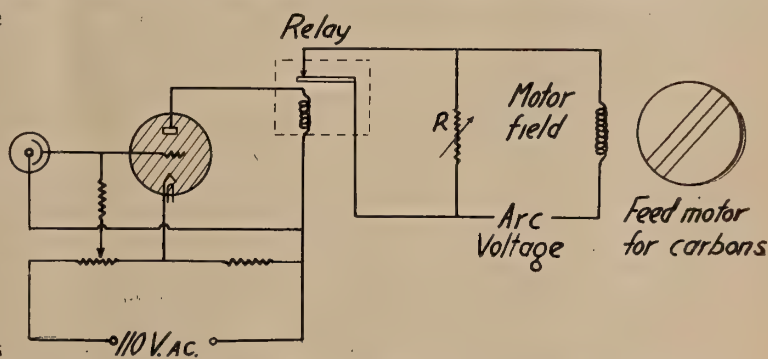
When the positive carbon burned back, the more intense light from the vicinity of the carbon tip struck the photocell, tripping the relay, which allowed the carbon to feed up until the light at the photocell was reduced to its original level, at which point the relay again became inoperative and the feed-motor turned to its normal speed.

The photocell control circuit used is shown in Fig 7, and employs a single gas-discharge "trigger" tube. The speed of the feeding motor is controlled as shown in Fig. 8 by means of a resistor in the motor field circuit which is short-circuited by the relay when the motor is running at low speed.

Since a variation in light-intensity exists also at the negative carbon tip, a double photoelectric control was constructed for controlling both positive and negative carbons by means of two photocells and associated amplifiers, giving constant arc length as well as constant arc position. This control was used in conjunction with a Suprex type of lamp modified to employ separate feed-motors for the positive and negative carbons.

A photocell circuit essentially similar to that of Figs. 7 and 8 was provided

FIGURE 8
Method of connecting cell and amplifier to control speed of motor feeding the carbons.



for each of the carbons. A side image of the arc was focused on the photocells placed outside the lamphouse. The light emitted from the vicinity of the two carbon tips was admitted to the respective photocells through a double slit placed at Performance data on this combination the arc image in front of the photocells. are given later herein.

It has been found possible to make bimetal arc controls which possess sufficient sensitivity and are capable of carrying the current necessary to change the speed of the lamp-feeding motor, and which therefore do not require amplifying equipment.

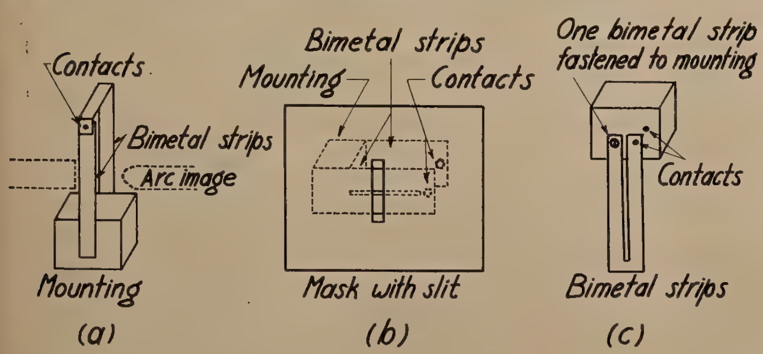


FIGURE 9
(a and b) Singly compensated thermostats; (c) doubly compensated thermostat.

Since the Curve *A* in Fig. 6 is a plot of the variation in total energy across an arc image, a curve of the deflection of a blackened bimetal strip *versus* the position across the image would be expected to have a similar shape with the maximum deflection occurring at the positions of the peaks on the curve.

The simplest thermostat would consist of a single bimetal strip with one end fixed and the other end free to deflect and make or break a circuit to a fixed electrical contact in response to changes of temperature of the bimetal caused by movements of the arc image. Such a thermostat, however, would be unable to differentiate between the radiant energy received from the arc and the heat received from the adjacent surroundings which may vary during the "warm-up" period of the arc lamp or because of room temperature changes.

Compensation can be made for the variable heat received from extraneous sources by replacing the fixed electrical contact point by one mounted upon a "dummy" or compensating piece of bimetal which is free to respond to the heat received from the surroundings but which is shielded from the direct radiation from the arc. This compensating member eliminates the effect of the surroundings and leaves the relative motion of the contact points dependent only upon the direct radiation from the arc.

Such a thermostat is shown in Fig. 9(*a*), in which the "dummy" bimetal strip is placed behind the "active" strip and thereby shielded from the direct radiation of the arc. For purposes of discussion, we have chosen to call this type of thermostat a "singly-compensated" one.

Another example of a singly-compensated thermostat is shown in Fig. 9(*b*). This differs from the one of Fig. 9(*a*) in that the length-wise direction of the bimetal strip is placed parallel to the axis of the carbons instead of perpendicular. Another difference is the use of a mask with a narrow vertical slit to restrict the portion of the arc image admitted to the bimetal.

With the thermostat of Fig. 9(*a*), the orientation and narrow width of the bi-

(*Continued on page* 23)

Army Camp Theatre Facilities Match Professional Field

Notes on Projectionist Training, Rating; Finest Equipment

By *STAFF SERGEANT A. J. SINDT*

CHIEF PROJECTIONIST, CHANUTE FIELD, RANTOUL, ILLINOIS

Earl Ingalls (left) Technical Engineer for U. S. Army M.P. Service, discusses features of the Simplex E-7 with S/Sgts. A. J. Sindt, chief, and E. W. Sindt, assistant projectionist—a unique Army brother team.

THE widespread notion that motion picture facilities for the entertainment of America's armed forces fall far short of the standards established in the professional projection field — the assumption being that the theatre itself is nothing but a glorified lean-to or shack and that the conveniences and equipment therein are at best of a makeshift character—can easily be dispelled by even a brief description of the two War Department theatres at Chanute Field. Rantoul, Ill. And these theatres are typical of almost all others throughout the U. S. Army Motion Picture service, containing, in the writer's opinion, the finest equipment available.

First, a few words about the theatres themselves. Each seats 1,038 persons and runs two performances daily, with matinees scheduled on Sundays and on all holidays. One of the theatres runs a morning show for the convenience of the students attending the Chanute Field branch of the Air Corps Technical Training School.

The screen is approximately 16 x 21 feet and affords an excellent view from all sections of the house. Each theatre has two ticket-windows, office space, a spacious lobby and a foyer. In general, the theatres do not differ greatly from civilian houses. Both theatres play the same picture, the print being "bicycled" between the theatres. A half-hour's difference in starting times assures adequate time for the runner to deliver the reels without interruption of performance in the second theatre.

All Photos by U. S. Army Air Corps.

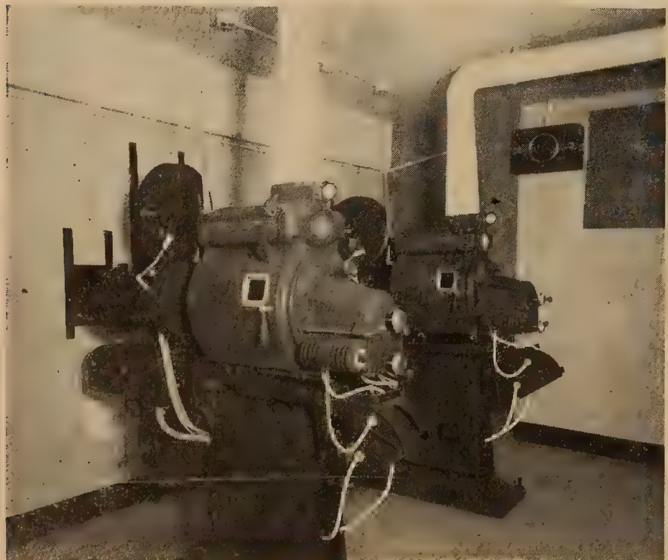
The rewind-room is separate from the projection room, and in it is installed the generator or the rectifier. Adjacent to the projection-room proper is a fireproof vault for the storage of film and general supplies. Simplex E-7 mechanisms, modern RCA sound systems, and Super-Simplex pedestals are used. The "throw" is 122 feet, and at Theatre No. 2 we find that 50 amperes provides a light of sufficient brilliancy and pleasing quality.

Two projectionists, a chief and an assistant, are on constant duty while the show is in progress, *and there is always a projectionist at the operating side of the projection machine in motion.* All personnel staffing the War Department theatres are soldiers, who receive "special duty" pay in accordance with existing regulations.

Projectionists must serve a probationary period of six months with the Army Motion Picture Service before drawing full-rating pay. Projectionists are obtained by two means. First, the greater portion of the men now working in Army theatres formerly were projectionists in civilian life. A concerted effort is made to place the experienced projectionists enlisting in the Army in a War Department theatre, if his ability bears out his apparent qualifications. Occasionally, students are trained, and they serve a long period of apprenticeship.

Maintenance and repair work is done by engineers of the Army Motion Picture Service, their tours being periodic and frequent. However, in cases of extreme emergency an engineer is dispatched immediately to correct the trouble within the shortest possible time.

The Army projectionist doesn't differ greatly from the projectionist employed in a civilian theatre. In most instances we have better equipment, since our installations were made comparatively recently. The Army Projectionist, too, takes pride in his work, and always endeavors to give the best possible performance.



Section of Chanute Field (Ill.) projection room No. 1.

View from stage toward rear of theatre auditorium.

Projection Room Routine Under Normal and Emergency Operation

By *HARRY RUBIN*

DIRECTOR OF PROJECTION, PARAMOUNT THEATRES

The accompanying article, originally issued as instructions for all Paramount projectionists (and in some aspects applicable to only the larger theatres which offer stage shows) is so exemplary of correct procedure as to compel its dissemination among all members of the craft. Of the author it need only be said that he is a projectionist of thirty-five years experience who has gained an international reputation in the art and whose work is appreciated most by brother craftsmen—than which there can be no higher praise.

YOU have been trained to always *keep the entertainment on the screen.* Now, since this country is at war and the public interest is of paramount importance, all your efforts should be directed more than ever before to keeping the show going at all costs.

Cooperation between the theatre manager, the stage and the projection room is very important at all times. We have always had this cooperation in the past, and now that there is a national state of emergency, this cooperation is more important than ever. The duty of protecting the public safety cannot be too strongly stressed. People come to this theatre to relax and be entertained. Any breaks in the program will mar their enjoyment of the show.

It must be borne in mind constantly that our patrons are apt to be in a nervous and jittery condition. Consequently it is absolutely essential that everyone in the theatre organization renew his efforts to keep the show going. By allowing nothing to spoil it, you will be doing your utmost to prevent the audience becoming panicky and upset. The entertainment and safety of the patron is largely in your hands, even though, like the engineer of a train, you are unseen.

Daily Pre-Show Routine

Your training as a member of the Paramount projection staff has included a routine to assure the presentation of perfect shows. It is necessary, however, in the present emergency, that you redouble your efforts. With this thought in mind I review in detail all the factors that you have known in the past, and I have added those which apply with particular force to the present situation.

Inspect all projection room fuses, fuse terminals, rheostat connections and switch blades and hinges. Make certain that all are making solid contacts and are in good condition.

Turn on room and projection arc ventilation exhaust fans and see that they are operating properly.

Inspect each projector, checking tensions of take-up and film gate.

Report any excessive wear of film tracks, tension shoes, sprockets, idler rollers, fire valves, gears or any other vital parts.

Check the clearances of all sprocket idler rollers.

Check each arc mechanism, noting the condition and tightness of the wire leads at the carbon contacts and at Projector switch. Check the tension and condition of carbon contacts and clean out any corrosion. Check condition of arc-feeding mechanism and motor. Lubricate arc motor, if required [every Monday].

Lubricate each projector mechanism magazine shaft and take-up. Run projectors for several minutes. Clean excess oil from projector. Clean projection lenses and arc condensers. Clean sound optical systems on each projector.

Checking Sound Amplifiers

Light and warm-up exciting lamp rectifiers. Light and warm-up all amplifiers [both sound channels]. Light and warm-up horn field rectifier.

Check meter readings for all tubes and exciter lamps and note the appearance and condition of each tube. Check sound separately on each of six loud speakers on stage. Check each projector for equalized sound level. Check operation of port shutter release control.

Start up motor generator. Check the operation of the arc when connected to the generator. Run one reel on first show with arc connected to generator. [Maintenance and oiling of motor generator is a function of the stage crew].

Examine daily schedule provided by the manager and consult with his office if there be any questions regarding the running of the show or regarding the film. Note whether any changes in cues have been posted on the bulletin board.

The day shift will make certain that all necessary information is communicated to the night shift and thoroughly understood by them. The night shift is required to post any such information on the bulletin board before leaving at night. This will include any arrangements made with the stage regarding the exchange of buzzer signals, *etc.;* also the correct normal fader setting for each film subject on the schedule.

During the Performance:

After each projector has been threaded and the arc trimmed by *one* projectionist, the work is to be checked by a *second* projectionist who will pay particular attention to checking that it is the correct reel as per schedule, that the film is making proper contact with each sprocket, that all loops are of correct length, that all idler rollers and film gate are closed and correctly engaging the film, and that the film is "in frame" in the aperture. He will also check that the take-up reel is not bent and that the film is firmly attached to the take-up reel.

While the film is being screened, a projectionist *must* be at the *operating side* of the projector and must give his *constant attention* to the picture on the screen and to the operation of the projector.

At each change-over between projectors, one projectionist must be at *each* of the two projectors with *both* men watching for the film change-over cues. The man on the "outgoing" projector will announce "Motor" when the first cue mark appears on the screen. He will say "Cut" when the second set of cue marks are seen. He will also change-over the sound.

The arrangement of all the work in

HARRY RUBIN

connection with the show is to be discussed in advance by the projectionists on duty and a *definite duty* assigned to each one. This is to provide that all necessary work will be covered without any duplication and each man will know which duties will be performed by the others.

After projecting a reel, it is to be removed to the rewinder where it is to be immediately inspected and, if necessary, repaired. After this is done, it is to be placed in its designated compartment of the vented film cabinet. *Under no circumstances* shall the film be permitted to lay about exposed either on the rewinder or in other parts of the projection room. Any extra films must be kept in approved metal cases.

Keep all spotlight and stereopticon ports closed when not in use. Avoid unnecessary noise in closing magazine or lamphouse doors or in the handling of tools or film. Avoid loud conversations which might be heard by the audience or any discussions which would distract attention from the show.

Cooperative Personnel Vital

Buzzer signals given by the projectionists are as follows:

Two buzz signals as a warning two minutes before the end of each subject on which the curtains are to close. [The stage acknowledges this by returning the two-buzz signal].

One buzz signal to the stage to close curtains.

On subjects which run four minutes or less, no warning is given to the stage but each such instance shall be prearranged with the stage crew.

On any subject which precedes the pit show a 2-buzz signal is given ½ *minute* before end of subject *instead of* 2 *minutes* before the end. This signal serves both as a warning and as a signal to start raising the orchestra pit.

Signals given by the sound observer to the projection room are as follows:

1 Buzz to indicate that sound level is to be reduced by one step on the fader.

2 Buzzes to indicate that sound level is to be raised by one step on the fader.

Emergency Equipment Provision

The theatre is provided with both D.C. and A.C. from separate power sources. In the event that the D.C. is affected by any disturbance and is not available for use, the motor-generator must be immediately switched on for the projection and spotlight arcs.

If the three-phase A.C. power fails:

Notify stage to close curtains. Project an effect on the curtains. An effect that has motion is preferred. This will provide some action for the audience to look at and will thus tend to allay nervousness and uncertainty.

Two separate one-phase circuits of the three-phase power service have been brought to the projection room for the sound equipment. The double-throw switch between these two circuits is located in the workshop. The fuses for this circuit are located in telephone room on the 8th floor. Keys for this room are kept on key board in projection room. If one of the phases blows out, throw the double-throw switch to connect with second circuit. [These instructions, of course, would vary with different theatres].

Three projectors are installed and all are to be maintained and operated in turn every performance, except on such occasions where one projector may be set up for special effects.

Two separate sound channels have been provided. If trouble develops on one of these, or sound quality is not up to standard, the sound must be immediately transferred to the second channel.

In addition to the horn field supply rectifier, a second source of power is provided. In case of trouble developing in this rectifier, the horn field supply must be immediately restored by throwing the double-throw switch that connects with the D.C. power through the rheostat.

Two separate rectifiers for the exciting lamps are installed. If trouble occurs with one of them, the switch must be thrown immediately to put the second one into the circuit.

The pre-amplifiers at each projector are arranged so that they can be instantly connected to either of the other two projectors by means of plug-in cables.

Three power amplifiers are provided which are interchangeable between the high-frequency and the low-frequency stage horns. If trouble develops in any, it must be immediately switched out of the circuit.

Weekly Drills Routine:

Weekly drills must be conducted covering all the aforementioned emergency operations in order that each projectionist will instantly know what action to take for each given emergency. Additional equipment and provisions made to handle the present emergency situation:

Rubber gloves have been furnished for use in handling electric circuits.

Asbestos gloves have been furnished for use in handling any objects that are hot or as a protection against flames.

A radio is installed to enable any broadcast information to be transferred to the theatre sound system.

A microphone with its switch and volume control is installed back-stage, permitting announcements to the audience for that location.

A battery-operated record player has been provided that can be used to entertain crowds in the lobby or elsewhere in the theatre.

The stage manager is furnished with battery-operated portable lamps and also a battery-operated portable public address system. Even in the event of complete loss of electric power these items will permit the stage show to continue.

Additional pails of sand have been provided to be used in smothering fires.

"Alert" or Air Raid

The Manager will notify the projection room.

Under no circumstances shall the performance be stopped except upon direct orders from the management!

In the Event of Fire

Drop all shutters immediately.

Shut off projector motors and arc switches.

Use sand to smother fire.

The use of extinguishers is not recommended, since the film generates toxic gases in burning and the extinguisher would only add a further amount of toxic gases to that of the film. Avoid inhaling the smoke and fumes as far as possible.

NEW BLUE-SENSITIVE P.E. CELL

What, asks L. G. R. of Chicago, is the significance to sound picture work of the recent announcement by General Electric Co. of a new blue-sensitive photoelectric cell that possesses about 30 times the quantum efficiency of red-sensitive types. The answer to which is that, while this new cell might possibly be utilized in production work for ultra-violet recording, it is not applicable to the reproduction process and therefore has no significance to the projection field.

BARROWS, BURKE HEAD L. U. 182

Thad C. Barrows and James F. Burke, perennial executives of Boston Local 182 projectionists group of the I.A., have again been named president and business representative, respectively. Other officers are B. McGaffigan, vice-president; R. Moulton, financial secretary; Joe Ritchie, sgt.-at-arms; and for the executive board, in addition to the aforementioned, J. Nuzzollo, John Diehl, and Louis Pirovano. Messrs. Barrows, Burke and Nuzzollo will be I.A. convention delegates.

Seating Preferences Charted; Hand Fire Extinguishers Held Futile

A REPORT OF THE THEATRE ENGINEERING COMMITTEE OF THE S. M. P. E.‡

THE committee is endeavoring to formulate plans for a series of surveys from which information may be derived which will indicate those zones of seating in the motion picture auditorium most preferred for comfortable viewing of the pictures. It is intended also to locate the zones of second, third, and even lesser choice for seating as selected by the audience after the more highly preferred areas are filled.

The Committee fully realize that there would be many significant factors which might change the pattern of the preferred zones; for example, the size and brightness of the picture might have a direct influence on the pattern. Also, the traffic lines into the auditorium and the placing of the aisle leading to the seats would be relevant factors.

While it is realized that poor sightlines due to improperly pitched floors and uncomfortable chairs might influence the location of preferred seating zones, the Committee feels that it would be wise to place little stress on these last two factors because theatres having such conditions could and probably should be avoided for this survey work.

To arrive at any worth while conclusions, it is felt that it would be necessary to make surveys for auditoriums of varied basic shapes, such as the square shape, the extremely elongated rectangle, and in-between shapes. It would also be necessary to survey theaters of varied capacities, the 600, 900, 1200-seat capacities being recommended for the tests. It would be preferable if the size and brightness of the picture could be varied for a given seating pattern so that their influence could be more definitely observed.

Many Difficulties in Checking

The first survey was made in a theatre under actual operating conditions. This type of survey can be made fairly accurate and gives a true picture of the preferred seating zones. The main difficulty, however, arises from the fact that it is necessary to have at least one checker for approximately every 60 chairs in an auditorium. Each checker must have a chart in front of him indicating the chairs in his zone so that he can mark the chairs as they become occupied.

Still another method of checking the preferred seating zones was considered in which the audience would be brought to an auditorium chosen for test purposes, and, under different conditions, be asked to seat themselves in accordance with their ideas of comfortable viewing positions. It is probably true that an unsuspecting audience would give more conclusive information, but there are definite advantages in this latter type of survey. It would not be necessary to have large squads of checkers.

Considerable travel and arranging of available time is involved in getting together a group of checkers to make a survey in theatres in actual operation. In the plan which involves the use of an audience chosen for the test purpose, the necessary changes in picture size and brightness could be made and their effect noted on the specific audience. It would also be possible to rope off designated seating areas in which the basic shape of the seating pattern could be varied to check on the influence of the basic shape.

Of course, one major obstacle to this type of survey would be the difficulty of obtaining an auditorium equipped with the necessary chairs and projection equipment for the tests. The difficulty of obtaining a sufficiently large audience could be minimized by spacing the chairs farther apart in both directions than would be normal practice so to decrease the required number of viewers; for example, the normal audience of 600 could be tested with approximately 200 persons.

An actual survey was made in the Surrey Theatre in N. Y. City. The tests were made starting at 6:45 P. M. and ending at 9 P. M. The theatre has a capacity of 570 chairs, and in the hours indicated 453 people entered the theatre to view the screen performances. The accompanying diagram indicates the plan of the theatre, the position of the screen, and the like. The results of this survey are herewith given (Fig. 1) and the Committee may continue with a series of these surveys unless it is found that other more practicable methods can be used to arrive at the necessary results.

Procedure in Actual Check

Eleven members of the Committee entered the theatre on a week-day evening at about 6:30 P. M. Each man occupied a specified seat from which he could view an area of approximately 50 seats. The survey started at 6:45 P. M. and terminated at 9 P. M., the evening period in which the major part of the audience was expected to arrive.

The total period was divided into three periods: 6:45 P. M. to 7:30 P. M. for the

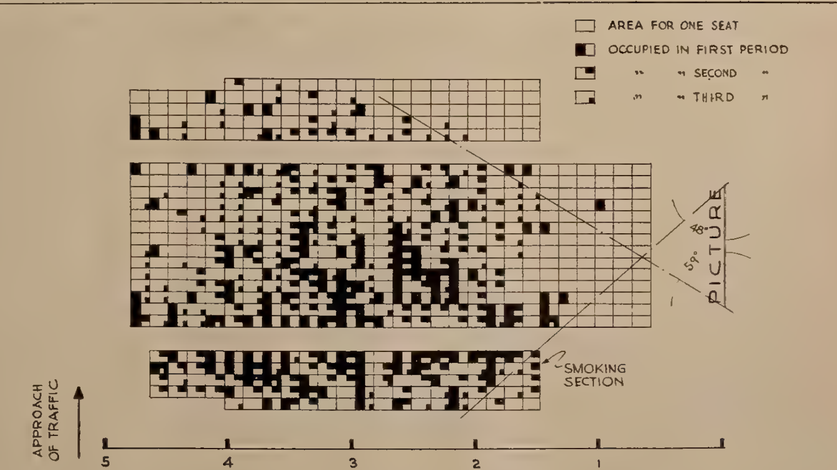


FIGURE 1. ***Theatre seating chart for determining preferred seating areas.***

‡ J. Soc. Mot. Pict. Eng.

first period; 7:30 P. M. to 8:15 P. M. for the second period; and 8:15 P. M. to 9 P. M. for the third period. Each man had a seating chart in front of him which enabled him to record those seats which were occupied in the first, second, and third periods.

Figure 1 shows the seating diagram of the theatre and black boxes of various sizes indicate in which period the chairs were occupied. Fig. 1 also shows the different weights given to the black markings in accordance with the period when the occupancy occurred. Greater weight was given to the earlier periods so that a visual picture could be obtained of the preferred seating locations. It also assumed, of course, that the chair locations occupied in the earliest period would indicate the highest preference.

In this particular theatre the facts that the approach of traffic was from one side rather than from the usual center approach, and that the smoking section was placed to one side, threw the weight of preferred seats to one side, as the chart indicates.

The picture size in this theatre was 12 ft., 7 in. × 17 ft., 5 in., and the screen illumination was a little above the average in intensity. The picture size was larger than the average size to be expected for the maximum viewing distance of this theatre. The maximum viewing distance was 4.85 × the picture width. In accordance with a previous survey made by the Committee, the average picture size in relation to the maximum viewing distance was found to be the maximum viewing distance divided by 5.2.

Significant Survey Data

It is not assumed at this time that this single survey could by any means give conclusive information as to preferred seating arrangements. It would be necessary to make approximately a dozen or more of these surveys under different conditions, as already suggested in this report. However, it is interesting to note some of the disclosures made by this survey. These are as follows:

(1) That seating locations in an area near the picture starting with the picture and ending with a distance approximately 1½ times the picture width away from the picture, are resorted to only very infrequently.

(2) That the preferred viewing distances from the picture are found in an area located at distances beginning at approximately twice the picture width and ending at approximately four times the picture width. Fig. 1 is marked with a scale at the bottom to show the relation of viewing distances to the picture width. Each unit marked on the scale is equal to the picture width.

(3) That seats located in an area too far to one side of the picture, or such as may be located outside an angle of approximately 60° in relation to the picture surface as shown on the chart, are not occupied any sooner than the two seats heretofore mentioned in the front sections, when other seats are available.

Conditions in this particular theatre did not permit any worth while observations to be made as to what could be considered as useful seating areas at more remote distances from the picture.

It is the conviction of the Committee that progress in the projection art requires that there be promptly made available, preferably by the projector manufacturers, information on exact methods and appropriate tools for measuring the wear of projector parts, data on the permissible maximum tolerable amount of wear of each part before required replacement, accurate methods of measuring such operating values as film tension at the gate, and the corresponding convenient tools for measuring and adjusting such operating conditions.

The Committee has endeavored for a period of years to secure such information and tools, and at this time regards the lack of such material as detrimental to the advancement of projection and accordingly urges the early availability of such data and tools.

Hand Fire Extinguisher Held Unsuitable

A SPECIAL subject dealt with the question of including hand-operated fire extinguishers as part of the equipment of the projection room. The first step in the study was to send communications to various manufacturers of hand-operated fire extinguishers, stating the problem and asking specifically the following questions:

(1) What effect has your extinguisher on burning film, especially of the cellulose nitrate type?
(2) What damage to other equipment in the projection room might be incurred from the use of the extinguisher?
(3) What, if any, possibly toxic vapors are produced from the use of the extinguisher on burning cellulose nitrate film, and in what amounts?

In view of the inadequacy of information pertaining to these subjects, no definite answers were available either from the manufacturers of the equipment or from the information at hand. However, the questions indicate some of the important data that should be obtained, aside from the question of establishing a policy with regard to the use of hand-operated extinguishers in projection rooms.

A reply received from Underwriters Laboratories, Inc. contains paragraphs of special interest, since the thoughts expressed agree strongly with the feelings expressed frequently in previous reports and at many meetings of the Committee. This opinion appears elsewhere in this report.

Another question considered by the Committee was a possible inconsistency between Sections 144 and 218 of the *Regulations* as recommended by the National Fire Protection Association and published as NBFU pamphlet No. 40. Section 144 reads as follows:

> Every room in which film is stored or handled, except film vaults, shall be provided with first aid fire appliances of types using water or water solutions. (Then follows a list of several extinguishers considered suitable.)

Section 218 reads as follows:

> In the event of film fire in a projector or elsewhere in a projection or rewind room, the projectionist should immediately shut down the projection machine and arc lamps, operate the shutter release at the nearest point to him, turn on the auditorium lights, leave the projection room, and notify the manager of the theatre or building.

It was pointed out that if the projectionist should leave the projection room in the event of a fire, there would be no point in having hand-operated extinguishers inside the projection room. The

(*Continued, col. 1, foot of next page*)

WARNER EARNINGS TOP LAST YEAR

Warner Brothers Pictures, Inc., earnings for the 13-week period ended Nov. 29 were approximately 50 per cent ahead of the corresponding quarter of last year, after increased income taxes. Last year the earnings for the quarter were $1,276,000.

BENNETT HEADS WARNER CLUB

Marty Bennett, assistant to Frank Cahill, director of projection for Warner Theatres, has been named president of the Warner Club, Inc., employees' home-office social organization.

New Photographic Lens Wins Trade Press Approval—But I.P. Dissents

THE non-technical industry trade press, with an amazing lack of knowledge about the technical aspects of making and showing motion pictures, has bestowed its benediction upon a new four-element photographic lens which is credited with some truly remarkable properties. Through the medium of a publicity release from its inventor—P. Stanley Smith, a New York radio engineer—it is learned that this new lens possesses virtues as hereinafter described:

"The new lens is confined to a distance of three-tenths of a millimeter in its axis movement but the oscillations are at the rate of 23,200 times per minute, thus continuously altering the focus so that all objects are uniformly in register from four feet to infinity. Although all objects are slightly softer in focus than with lenses of a fixed focal length, many photographers regard this as an improvement.

"Smith, following the work of Dr. Ludwig Dieterich, an Austrian-born engineer, who patented a mechanical method for vibrating a lens element, designed an electronic method of achieving this purpose and has successfully incorporated the lens in a motion picture camera which it is believed will offer greater flexibility in motion picture photography and direction.

"At present action must be kept mobile within the set focus of the camera. Actors must work within a chalk line necessitated by the focal range of the camera. Lighting must be rearranged for each new focus, cameras reset, and distances taped.

"The new electroplane camera, with a lens which keeps all moving objects in perpetual focus, holds the promise of a solution to one of the chief limitations in motion picture photography."

Now, changing the focus of a lens during the exposure is an old precedure. It is worth considering just what happens when the lens focus is shifted, during the exposure, from foreground to background.

Shifting Lens Focus Effect

When the lens is focused on the foreground, it is self-evident that the foreground is in sharp focus. If the background lies outside of the usual depth of the lens at the stop which is used, it is equally evident that it will be out of focus. The film, which has no particular discrimination or selection ability in itself, will accordingly photograph—or start to photograph—a sharp foreground and a blurred background.

If the lens is now shifted so that the focused zone moves toward the background, the image of the foreground will get progressively softer and more fuzzy, and the image of the background will become increasingly sharper. When the lens is finally focused on the background at the end of the exposure in this simple case, the background will be in sharp focus but the foreground will be badly blurred.

The photographed picture at each distance from the lens will therefore include first one sharp but brief component and an infinite number of increasingly soft and finally very fuzzy components. This will hold for *all* distances from the lens, so that the picture will be nowhere sharp.

Picture Quality Sacrificed

It is easy enough to increase the depth of a lens by spoiling picture quality. But the projected pictures are enlarged hundreds of times on the screen in the theatre, and the best lens quality is just good enough for clear and sharp reproduction. Except where soft and foggy effects are deliberately desired in special cases, enlarging very soft film is the wrong way to produce good pictures in the theatre.

There is no question that increased depth is highly desirable in motion pictures. But the way to get it is not to start by sacrificing the most important characteristic of good pictures, namely their sharp and clear quality.

Committee felt that a hand extinguisher might perhaps be of use in cases of small fires from sources other than film, but in turn it was pointed out that nothing that would be likely to burn was permitted in the projection rooms, according to the *Regulations.*

There is apparently no definite information concerning cases of fire where hand fire extinguishers have been used, and most of the information available with regard to film fires in the projection room and the extinction of such fires is incomplete and sometimes questionable. The general consensus of the Committee may be summed up as follows:

(1) The Committee felt that no hand-operated extinguishers should be in the projection room.

(2) One or more hand fire extinguishers should be available immediately outside the door or doors of the projection room.

(3) The Committee still feels that in the event of film fire, the projectionist should immediately leave the projection room, so that Section 218 of the *Regulations* is to be regarded as satisfactory; but that Section 144 should either be omitted entirely or revised in accordance with Items 1 and 2.

Opinion of the NBFU Anent Hand Fire Extinguishers

We attach a copy of the *Regulations of the NBFU for Nitrocellulose Motion Picture Film.* Section 19 of this pamphlet is intended to afford necessary safeguards for booths, including vents, shutters, and noncombustible construction. We may call your attention to the note following sub-paragraph J appearing on p. 22 of this pamphlet. This note recommends the installation of automatic sprinklers wherever practicable.

In our study of the subject we have come to believe that the fundamental purpose of the above *Regulations* is to afford protection to the other parts of the building and to the occupants rather than to suggest means of controlling any film fires which may actually occur within the projection room.

As you know, such fires burn rapidly, give off intense heat, and great volumes of suffocating fumes and in our opinion ordinarily could not be controlled by hand-operated extinguishers of the usual type, even though it were possible for the occupants of the projection room to put such extinguishers into action and remain within the booth for any appreciable time followng the start of a fire. Also, nitrocellulose film is not dependent upon supplies of oxygen from the surrounding atmosphere.

The entire intent of the *Regulations* therefore seems to be that the operator should try to get out of the room as quickly as possible and hope that the booth itself was so constructed and ventilated that the film fire would burn out without extending into the building and without emitting a hazardous volume of fumes to the rest of the surroundings.

In our opinion, the safety of booths can not be made dependent upon hand fire extinguishers. It would, of course, be well to have proper extinguishers close at hand outside of the booth in case a need for them should arise.

You will observe in Section 14, Rule 144, of the *Regulations*, a note which recommends small hose equipment and extinguishers except in film vaults. This is probably a reasonable recommendation, but we would not depend too much on extinguishers to handle film fires unless of the very smallest size and only if the extinguishers were brought into action quickly before very much film was involved. It is probably more true of films than of other combustibles that protection is to be sought in preventing fires rather than by provision for extinguishing them after they have once started.

ALTEC-INTERMOUNTAIN PACT

Tracy Barham, of Intermountain Theatres, Inc., Salt Lake City, has negotiated an agreement with Altec for sound and repair-replacement service for 5 theatres in the circuit.

THE KENT LINE INCREASES

Wesley Kent, Altec service engineer in the New York district, is the proud pappy of a baby boy, Wesley Kent III.

NEWSPAPER CHALLENGED ON PROJECTIONIST IMPORTANCE

REFLECTED in the appended communication is the old, old story of "out of sight, out of mind", which has frequently militated against the best interests of projectionists. Herewith is appended a copy of a letter sent to Ed Sullivan, nationally-syndicated columnist of the New York Daily News by one of the outstanding members of the craft:

"In your interesting column, 'Little Old New York,' you recently gave some good ideas as to organizing theatres for emergency and air-raid conditions. Actors, stagehands, and musicians were all included in your plan —as they should have been. But the projectionist, who definitely is most strategically located in every motion picture theatre, was conspicuously omitted.

You have made personal appearances in the N. Y. Paramount Theatre and in other large picture houses, and I am sure that you know the importance of the projectionist and would not slight him deliberately.

Almost anyone in a motion picture theatre —except the projectionist— could be spared for a while without occasioning audience uneasiness. If musicians, actors, and stagehands were unavailable for a while, the projectionist still could put some music through the public address system and keep the audience fairly happy. This is no reflection whatever on those other very necessary groups of theatrical workers but only an indication that their temporary absences, while unsatisfactory to the audience, would not be an outright disaster. Even the doormen and ushers, useful as they are, do not carry quite the heavy burden of responsibility which every projectionist must share.

Efficient But Unseen Craftsmen

But you are well aware of what happens if the projectionist should fall down on his job. Let there be the least interruption of the picture on the screen or the sound from the loudspeakers, and the audience instantly expresses its annoyance very emphatically. Is it possible that the importance of the projectionist is appreciated only when some unit of projection equipment breaks down? And have projectionists generally done their difficult jobs so well that the audience is unaware of it, and becomes interested or resentful only in the rare instances when their work is interrupted?

If there be trouble in the projection room with film or machinery, it is the projectionist who must skillfully and calmly do just the right thing in the right way. The audience depends on him not only for entertainment but even for its own comfort and safety. To give you some idea of the duties and obligations of the projectionists under normal and emergency conditions, I attach some material applying to the routine and training and emergency instructions of Paramount projectionists.

I hope you will realize the importance of this large group of skilled and hard-working men who, busy in the projection room day after day, turn millions of feet of film into entertainment and pleasure for the theatre audiences of America. And, what is more, I hope you will agree that they should be seriously considered when theatre organization for emergency conditions is undertaken. The duties and responsibilities that they carry out even under normal circumstances are heavy indeed; and under emergency conditions they are the type of careful and cool-headed men who can be depended upon to help in the organization of theatre emergency routine. Don't you agree?"

HARRY RUBIN
Director of Projection, Paramount Theatres.

To the Editor of I. P.:

In submitting herewith another subscription to I. P. for one of our members, it occurred to me that it is worthy of note in

your columns that it is a standing rule in this organization that this Local present each member who enlists or is drafted into the armed forces a subscription to I. P. This is our fifth order of this nature.

JOHN A. MARTIN
Sec., L.U. 277, Bridgeport, Conn.

Green Light for S.M.P.E. Hollywood Meet, May 4

Emphasizing the important role played by the motion picture industry in maintaining American morale, the Society of Motion Picture Engineers has decided to hold its Spring Convention in May, as has been its custom for 25 years. The meeting will be held in Hollywood, according to William C. Kunzmann, Convention Vice-President.

"The motion picture industry plays an essential part in upholding the morale of the public in the present crisis," Mr. Kunzmann said. "SMPE members have many noteworthy technical advances in the motion picture art to report. Accordingly, the Convention and Local Arrangements Committees are proceeding with preparations for the meeting as planned. The convention will be in session five days, starting May 4."

He added that the Society reserves the right to cancel the convention program up to 30 days before the opening date if such action is deemed advisable in the national interest. Nine technical sessions are scheduled for dicussion of the most recent developments in the engineering and technical divisions of the industry. Ample time will be allowed for visits to the studios and for sightseeing.

SILVER-LINED BLACKOUT BULB

Designed for blackout lighting in air raids, and particularly adaptable for theatres, the new Wabash Blackout bulb just announced by the Wabash Appliance Corp., Brooklyn, N. Y., provides downlighting in a soft beam of blue light that is safe for indoor visibility during blackouts. The bulb is lined inside with a pure silver reflector lining that hides all filament glare and projects the light downward. Light leaks are prevented by a black silicate coating that covers the bulb up to the extreme lighting end which is a deep blue. The new bulb consumes 25 watts and will list at 45c.

W. E. COMMON DIVIDEND

At a meeting of the directors of Western Electric Co. a dividend of 75 cents per share on its common stock was declared. The dividend is payable on December 30.

RESULTS OF L. 306 ELECTIONS

Results of the election of officers of I. A. Local 306 (N. Y. City projectionist) at its regular biennial election were as follows:

President, Herman Gelber, who defeated Joseph D. Basson, the Local's president since 1935, by a vote of 1,024 to 821; Vice-president, Steve D'Inzillo who defeated a field of five; recording secretary, Nat Doragoff who defeated two other candidates; financial secretary, Charles Beckman, re-elected; treasurer, James Ambrosio, re-elected; N. Y. City business agent, Bert Popkin, re-elected; Brooklyn business agent Jack Teitler, re-elected.

Board of three trustees was elected—William De Sena, Herman Boritz and George Magarian. Of the 2,152 members, 1,975 voted.

F-P CANADIAN NET SWELLS

Famous Players Canadian Corp., Ltd., reports earnings after bond interest, but before income and excess profit taxes, for the nine months ended Oct. 4 at $1,898,142, compared with $1,669,420 for the 12 months of 1940, and $1,091,706 for 1939.

Despite a sharp jump in income and excess profits taxes, the balance of net earnings was $802,602 for the nine months, or at a considerably higher annual rate than the $1,007,064 reported for 1940 and $828,032 for all of 1939.

LOEW'S, INC. 11 MILLION NET

The annual report of Loew's, Inc., and subsidiaries reveals a net profit for the fiscal year ended on Aug. 31 of $11,134,593 after all deductions, including $3,747,298 provision for Federal income and excess profits taxes.

The earnings are equivalent to $6.15 a share on 1,665,713 shares of no par common stock outstanding, after allowing for dividend requirements on the preferred. In the preceding fiscal year the net profit

amounted to $8,908,470, or $4.82 a common share.

5% WEEKLY WAGE FOR DEFENSE

Employes of Martin Theatres here voted unanimously for 5 per cent of their weekly salaries or wages to be invested in Defense Savings Stamps and Bonds. Plan is expected to cover 2,200 employes of the Martin Circuit's 70 theatres in Georgia and Alabama.

PHILLY ALTECMAN TO NAVY

Frank J. Homsher, formerly Altec inspector in the Philadelphia area, has been commissioned a lieutenant in the U. S. Navy, as a specialist in radio.

93 TRI-STATES THEATRES RENEW RCA SERVICE PACT

Continuation of RCA sound service and the furnishing of parts and tubes to the 93 theatres of the Tri-States Theatre Corp. and Central States Theatre Corp. of Des Moines has been assured under the terms of a new contract just signed.

The pact marks the start of the fourth year of RCA service to the groups of theatres, according to W. L. Jones, RCA National Service Manager. Negotiations were conducted by Myron Blank for the theatre companies and George Sandore, RCA District Service Manager. The houses are located in Iowa, Illinois and Nebraska.

FRAUD SUIT AGAINST B. & L. VOIDED IN FEDERAL COURT

Federal Judge Alfred C. Coxe (N. Y.) has dismissed the $40,000,000 suit brought by Murray Brensilber and Samuel Thibner, New York lawyers, against Bausch & Lomb Optical Company; Carl Zeiss, Inc. and three B. & L. executives. The case was brought under an old Civil War statute and Judge Coxe, after hearing argument, said he was convinced that the statute, which authorized citizens, in cases of fraud against the government, to bring suit for double damages on behalf of the United States and themselves, "does not apply to this case, nor to anti-trust proceedings."

Whitney Seymour, attorney for Bausch & Lomb, said that Judge Henry W. Goddard, before imposing fines in a government proceeding under the Sherman anti-trust law against the same group of defendants, had asked whether there was evidence of fraud and had been told there was not. He noted, too, that a plea of nolo contendere (no contest), not one of guilty, had been entered in the anti-trust case.

"Furthermore," said Seymour, "these defendants are devoting their time intensively to the production of instruments for use in

national defense. The charge of this complaint, which is not true, that my clients conspired to charge the government 20 per cent over the proper sales prices of their products, is one that is seriously embarrassing to them, and unjust." Counsel for the defendants called the charge "false and fantastic."

DAYLIGHT-SAVING TIME FEB. 9; THEATRE BIZ UNWORRIED

President Roosevelt has signed a bill placing the entire nation on daylight saving time, effective at 2 a.m. Feb. 9. The statute, which will place clocks one hour ahead, will continue in effect for the duration of the war and for not more than six months thereafter. The move will save an estimated 500,000 kilowatt hours of power annually.

While daylight saving during Summer months has had some effect on box-offices, the extent of the harm has been greatly exaggerated in the opinion of trade authorities. A checkup last year of theatre business in localities where daylight saving went into effect and in spots where the clocks were not moved ahead revealed that there was practically no difference in grosses.

ASC ASKS SEPARATE CHARTER

By a vote of 117 to 21 members of American Society of Cinematographers voted against joining I.A. Photographers Local 659 and instructed their officers to continue their campaign for a separate charter in the I.A.

ASC has a five-year contract with major picture companies and it is understood producers favor separate charter for it.

INCREASED ADMISSION PRICES URGED BY EXHIBITOR LEADERS

A general increase in admission prices, especially in theatres in the larger cities, is urged by Pete J. Wood, secretary of the ITO of Ohio, in an organization bulletin.

Commenting on the need for high scales, Wood wrote: "All business analysts are agreed that we are in an inflationary period and we will all know that every type of commodity has gone up in price. We, however, are selling our merchandise at practically the same prices that we were a year ago but, in view of what we face in increased Federal taxes of many sorts, I cannot see how we can much longer adhere to these lower scales of admission.

"The first-runs in these cities have, in most instances, an established night price of 47 cents gross. If this rate were increased to 50 cents gross, the subsequent-runs now charging 30 cents could very well increase to 33 cents gross, and the 25-cent houses to 28 cents gross. With the additional money in circulation and the increased cost of practically all commodities, there would be little complaint received from patrons."

The public expects to pay more for first-run quality features just as it expects to pay more for everything else, in the opinion of James Hone, executive secretary of the Northwest Theatre Owners Association.

Hone advised his members that they should find out what they have to get for pictures and then get it.

SOME IMPROVED METHODS OF CONTROLLING CARBON ARCS

(*Continued from page 13*)

metal strips effectively perform this function of a slit. In this arrangement of Fig. 9(*b*), wider and thinner, and more sensitive pieces of bimetal have been employed. A lengthwise slot in the center of each strip was used to avoid "cross-buckling."

Singly-Compensated Thermostat

With the singly-compensated thermostat, the initial setting of the positions of the electrical contacts determines the amount of radiation the bimetal must receive from the arc to effect interruption or completion of the electrical circuit. This type of thermostat can be utilized as follows for control of carbon position:

The thermostat contacts are connected to short-circuit a resistance in the field circuit of the motor that feeds the carbons, giving a high speed when the contacts are open and a low speed when

they are closed. The thermostat contacts can be set to close at a point on the arc image on the falling part of the energy curves of Fig. 6 in the arc stream just in front of the positive carbon. If the carbon burns back, less energy will be received by the thermostat, which can be arranged to open its contacts and speed up the motor, feeding the carbon forward and increasing the energy on the thermostat until the contacts close and reduce the speed of the motor.

The gradient of the energy *vs.* position curve along the arc, such as *A* in Fig. 6, determines the sensitivity to arc position with which such a thermostat will function. Therefore, any procedure that increases this gradient, such as the use of a filter described in connection with Curve *B* of Fig. 6, will improve the sensitivity of the types of thermostat shown in Figs. 9(*a*) and (*b*).

Changes in the overall level of intensity of radiation received at the arc image would tend to result in a shift along the arc image of the point at which the singly-compensated thermostat closes its contacts due to its inherent property of requiring a fixed amount of radiant energy. The gradient in intensity from carbon to arc stream as shown in Curve *B* of Fig. 6 is sufficiently abrupt, so that the point along the arc stream where the contacts of the thermostat close will not shift appreciably.

With energy distribution curves along the arc such as shown in Fig. 6, there will necessarily be two points, one on either side of the maximum, at which the thermostat will close. If one of these is used for arc control as previously described, the other will affect the feed motor in a sense opposite to what is required. The possibility of the thermostat's being displaced out of its operating range will be lessened if the two points at which the thermostat closes are separated as widely as possible on the arc image which, as can be seen from Fig. 6, means operating the thermostat at as low energy as practicable. This is more feasible with Curve *B* than Curve *A* of Fig. 6 because the gradient, which has been shown previously to be important to sensitivity, can be kept abrupt at low values of energy.

Another form of thermostat is well adapted to the type of energy distribution along the arc shown in Fig. 6. An example is shown in Fig. 9(*c*). Two adjacent strips of bimetal are employed, rigidly linked together at one end. With the thermostat illustrated in Fig. 9(*c*), mounting is accomplished at one of the unlinked ends of the strips, leaving the other unlinked adjacent end free to move and make contact with a fixed point.

Both bimetal strips receive radiation from the arc and bend in the same direc-

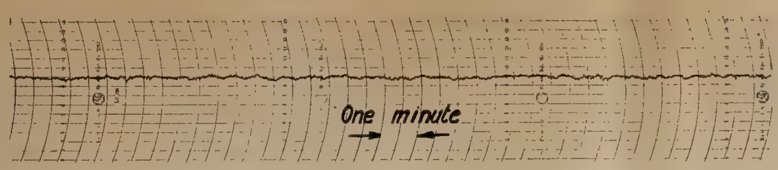


FIGURE 10. ***Record of light at center of screen over 20 minutes, using doubly compensated thermostat plus constant-current relay.***

tion when heated. They are placed with respect to the arc image so that one is on either side of the maximum of intensity at the positive carbon shown in Fig. 6; thus both strips are approximately equally heated.

If the arc image is displaced in either direction, due to movement of the carbon, one strip becomes heated more strongly than the other, resulting in opening or closing of the contacts, which can be made to control the feed-motor in the same manner as previously described.

Such a thermostat has two degrees of compensation. In the first place, as with the singly-compensated type described previously it is compensated for heat received from the surroundings, since this causes equal deflection of both strips which leaves the separation of the contacts unchanged. Second, it responds only to displacements of the position of maximum intensity on the arc image and is unaffected by general overall increases or decreases of the level of the curves of Fig. 6, such as would occur with increase or decrease of arc current. We have called this a "doubly-compensated" thermostat because of this twofold degree of compensation.

The various examples of singly- and doubly-compensated thermostats shown in Fig. 9 have been constructed and tested. A simple bracket mounting the lens and thermostat was fastened to one window of a Suprex-type lamp. The lens was supported about four inches from the arc, giving an image on the thermostat just outside the window. The thermostats were constructed of W. M. Chace Co.'s Type *2400* bimetal, heat-treated by the manufacturer to a temperature of 700°F. The thickness of the bimetal was 0.010 inch, except for the thermostat of Fig. 9(*b*) which was 0.005 inch thick. The material was used in the form of strips about 1 inch long and 0.1 to 0.2 inch wide. Platinum-faced contact points obtained from the H. A. Wilson Co. were employed.

Arc Control Performance

Double-Photocell System.—To evaluate the performance of the double-photocell control previously described, Suprex trims were burned for 20 minutes each and the positions of both carbons were read on an enlarged side image. Readings were begun two minutes after the arc was struck, and no adjustments were made on the lamp, photocells or amplifiers during the test.

The observations on the accuracy with which the carbon positions were maintained have been reduced to the statistical basis shown in Table I, giving the per cent of the total time that the carbons were held at various distances from the original arc position.

TABLE I

Test of Accuracy of Carbon Position Control with Double Photocell

	Per Cent of Time Held Within Limits Specified: 0.000 In. to 0.015 In.	Greater than 0.015 In.
Positive carbon	80	20
Negative carbon	90	10

This table shows that the double-photocell control was capable of limiting the variation of carbon position for the most part to less than 0.015 inch, with a few excursions greater than this. Since the photocells are biased so as to respond to departures from light levels determined at the time of the initial adjustment, any change from the initial conditions that causes light variations, such as line-voltage fluctuations, results in a change of the positions at which the carbons are held. This is probably the reason for the few cases in which the change in position exceeded 0.015 inch.

Performance Tests on Thermostats.—Performance tests were made on a Suprex-type lamp adapted to accommodate various examples of the singly- and doubly-compensated thermostats described previously. These were used to control the position of the positive carbon.

The feeding of the negative carbon was accomplished through a separate motor which was controlled by a magnetic relay responsive to the arc current. In this manner the negative carbon was advanced by just the amount necessary to maintain the arc current constant. This combination is designed to eliminate the effect upon screen light of movement of the arc crater and variations in power supply.

A considerable number of trims of Suprex carbons were tested and observed as described in connection with the photocell evaluation. The data on the accuracy of positioning the positive carbon are shown in Table II on the same statistical basis as that used for Table I.

TABLE II

Tests of Thermostats Shown in Fig. 9 in Conjunction with Constant-Current Control

Type of Thermostat	Per Cent of Time Positive Carbon Held Within Limits Specified: 0.000 In. to 0.015 In.	Greater than 0.015 In.
Singly compensated (Fig. 9*a*)		
Without heat filter....	78	22
With heat filter......	85	15
Singly compensated (Fig. 9*b*)	96	4
Doubly compensated (Fig. 9*c*)	99	1

The data in Table II show that all the thermostats restricted the position of the positive carbon most of the time to within 0.015 inch of the correct position. The use of the heat filter described in connection with Fig. 6 improved the accuracy of control obtained with the singly-compensated thermostat of Fig. 9*a*. The superior performance of the singly-compensated thermostat of the type shown in Fig. 9*b* may be due to its differences in construction and method of application as discussed previously herein.

The best performance of all in Table II is shown by the doubly-compensated thermostat. This can probably be attributed to its different principles of operation and inherently greater degree of compensation. It must not be assumed that these data in Table II represent the ultimate in performance. Further improvements may bring the performance

of the singly-compensated thermostats up to that shown by the doubly-compensated one.

While comparison of Tables I and II indicates that the double-photocell control was not quite as effective as the thermostat devices, refinements are, however, possible for the photocell that can improve the precision of arc control obtainable with it. For example, the use of the constant-current relay for the negative carbon and one photocell to fix the positive carbon position would no doubt result in more precise control.

Furthermore, just as a filter was used to increase the gradient in radiation between the positive carbon and arc stream as shown in Curve *B* of Fig. 6, suitable filters may be employed to increase the sensitivity of photoelectric cells to movement of the arc image.

It is possible also to devise photoelectric means utilizing one of the important principles of the doubly-compensated thermostat—namely, the property of responding only to the position of maximum intensity on the arc image and not to the level of intensity. This can be achieved through the use of a special photocell consisting of two adjacent cathodes placed one on each side of the maximum of intensity in the arc image.

These control devices have been used in connection with commercial reflector-type lamps in the experimental work described. Some modification of the mechanism and method of operation of these lamps is necessary in order to obtain independent control over both the positive and negative carbons. While the emphasis herein has been chiefly on the application of these methods of arc control to reflector-type, high-intensity lamps, they can be used also with other types of carbon arc lamps to effect automatic control.

The primary aim of all these arc-control devices is to maintain constant light on the projection screen. The chart shown in Fig. 10 is a record of the light-intensity at the center of the screen over a 20-minute period without the projector shutter running, using the doubly-compensated thermostat whose performance is given in Table II. This thermostat plus the constant-current control was used with a Suprex-type lamp burning the 8-mm.–7-mm. trim at 62 amperes.

The trace shows that over a 20-minute period, the average light level remained constant within about two per cent. and the extreme variation from this level was only about four per cent. This demonstrates that these automatic controls can effectively maintain constant light on the screen. The employment of such methods of arc positioning, therefore, makes possible significant advances in the quality of motion picture projection.

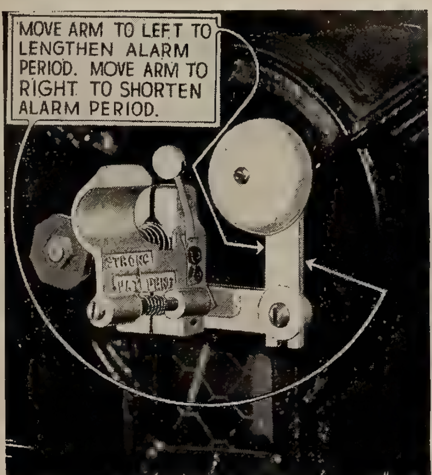
Why Risk Faulty Changeovers?

(From "Some Current Changeover Practices," I. P. for May, 1941.)

AN OLD-TIME projectionist friend of ours . . . tells us that he has had no less than four aperture fires in one day because of tin foil cemented onto film to operate homemade reel alarms. The foil, placed along the inner side of the film, not the sound-track side, scrapes off at the intermittent sprocket, our friend says, pushing the shoe back. The whole strain of moving the film, therefore, falls on the sprocket holes at the sound-track side. These tear. The film stops moving, and catches fire.

. . . Such prints go through the exchanges with foil cemented to them, and the exchanges do not remove it . . .

Reel-end alarms of either the contact or the centrifugal type might . . . be given more consideration than they have had to date, particularly by those managers who consider a poor changeover an unpardonable crime . . .



STRONG REEL-END SIGNAL IS

Adjustable

for Either 4- or 5-inch Hubs

PRICE: $8.50 each

The Strong Reel-End Signal Offers Positive Protection

This device *does not* touch either the reel or the film. It is strictly mechanical and requires no batteries, no transformers, no governors, and no pre-setting by the projectionist.

It is not dependent upon any change in the normal, smooth operation of the projector.

It is installed within 5 minutes, requiring no drilling. Once installed—forget it, as has been demonstrated conclusively by more than 1200 installations in theatres throughout the United States.

About one minute before the end of the reel the STRONG REEL-END SIGNAL begins to ring, continuing distinctly for 15 seconds—then it stops. The duration of the bell-signal can be increased or decreased by simply moving the arm to either the right or the left (see illustration). Here is a device that will end *permanently* all your changeover troubles. Simply yet sturdily constructed, the STRONG REEL-END SIGNAL has given complete satisfaction in hundreds of theatres where it is installed.

STRONG also manufactures the famous ZIPPER CHANGEOVER with treadle mercury switches in a variety of models suitable for *all* American-made projectors, including Simplex, Brenkert, Motiograph and Kaplan mechanisms. This unit weighs only 20 ounces and is *guaranteed* against trouble for one year after purchase. STRONG CHANGEOVERS have led the field for 25 years.

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PROJECTIONIST

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It must be *Bright!*

Just as any sign on Broadway must be bright to draw attention, so too, must the light from your projection lamps today be bright to secure the desired screen brilllancy with present dense films.

TWICE AS MUCH LIGHT is required as is possible to project by any low intensity lamp.

This necessary doubling in light is possible at an increased combined current and carbon cost of LESS THAN 2c PER HOUR, with the low cost Strong Utility High-Intensity Projection Arc Lamp.

Without the snow-white light such as is secured by this lamp it is impossible to show colored films satisfactorily. The light of your old low-intensity will appear a dim, muddy yellow by comparison.

Increase your business by installing Strong Utility One-Kilowatt Arc Lamps now. Theatregoers readily recognize good projection and go where it is offered.

FREE DEMONSTRATION

Write your Independent Theatre Supply Dealer today for literature, or have him arrange a demonstration in your theatre without obligation. Strong products for years have been recognized by thousands of theatres as the most dependable guide to best projection. Complete details will be sent on request by The Strong Electric Corporation, 2501 Lagrange St., Toledo, Ohio. Export office: 90 Gold Street, New York City.

International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by James J. Finn

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Monthly Chat

IT CAN happen here! We mean it will be only a matter of time when women will take over many of the projection booths in this country. When approximately 7,000,000 men are called to the colors during the next two years, it will leave few men outside of essential war industries. This is where the gals come in.

England has already tried out the scheme and it works. The ladies have learned the intricacies of the projection machines and can make minor repairs and adjustments. The more complicated repairs are taken care of by cruising service men. Thus far the women operators have shown themselves efficient.

The old theory that a woman can't even drive a nail straight is not borne out by the records of women operating delicate machines in defense industry. At first the men may try to laugh off the idea that women can hold down the jobs, but sooner or later, the gals will take over.

If you male operators think that girls will give up these jobs when the war is over, then you just don't know the female specie. Unless the men have a definite arrangement to return to their jobs after serving with Uncle Sam, there is going to be trouble.

• • •

While on the subject of war, we can no doubt look forward to great strides in the picture industry when peace returns. Following every war engineers use the knowledge they have gained in time to improve peace time industry. After the last war we were given talking pictures. This time it may be theatre television, or something as yet not even thought of.

Here's where you come in. Many of you will recall that some old-timers scoffed at the idea that sound pictures would ever be anything other than a novelty and declined to take them seriously. As a result the far-seeing operators studied the new mechanism and gained thereby. The scoffers were soon tossed into the discards.

Don't make that mistake this time. Keep abreast of new improvements and keep yourself a valuable member of your craft. We don't expect the industry to be completely revolutionized by a single invention, but we do expect better, but more complicated, machines and it is up to you to be master of them.

A great many of you who will be called to the colors will no doubt be assigned as a projectionist to operate the hundreds of machines in camps, hospitals and foreign bases. It isn't likely that you will become rusty at your professions due to lack of practice, for the government and the studios have taken good care that the men in service will see the best pictures at frequent intervals.

INTERNATIONAL PROJECTIONIST

VOLUME XVI DECEMBER 1941 NUMBER 12

Physical Characteristics of Film

By *HENRY SHARP*

MEMBER, AMERICAN SOCIETY OF CINEMATOGRAPHERS

NOW that America is in the war on an "all-out" basis, we're hearing more and more on the subject of conservation. We're being asked to do entirely without some things and we're being asked to make existing supplies of many other things last longer, and do their work more thoroughly than ever before.

First of all, make sure your projector isn't doing anything that will injure film. Clean the gate carefully, removing any stubborn specks of hardened emulsion-scraps or dirt. Then take a few feet of fresh film—preferably film which hasn't been projected—and make a loop of it. Thread this through the projector and run it continuously for ten or fifteen minutes, and see if any scrătches develop. If any serious ones do, have the projector checked over by an expert, either at the factory or at some dealer in whose repair-shop you've genuine confidence.

We're really very fortunate today that there are a number of systems by which film can be, if not, perhaps, absolutely immunized from scratches and fingermarks, at least protected from all but the worst of them. And those "worst" abrasions should never occur under careful handling.

There are two sides to this problem of protecting film. One, appropriately, for each side of the film. Most of us seldom give much thought to the composition of the little strip of film that carries our pictures, but it's a surprisingly complex creation—the more so since it's only a few thousandths of an inch thick.

The base of it is a strip of celluloid, 35mm., 16mm., or 18mm. wide, as the case may be. On one side of it is coated a layer of gelatin in which is carried the light-sensitive emulsion which records the picture and eventually, after appropriate processing, becomes the picture-image which is projected.

Characteristics of Gelatin

This gelatin which carries the picture is a remarkable thing. It's microscopically thin. It's transparent. It's flexible. And in its relations to moisture, it's unique. In an absolutely dry form, gelatin is a hard, dry solid. In its wettest form, it has absorbed from 18 to 20 times its bulk in water, and is perfectly fluid.

Unlike crystalline substances, the gelatine molecules (which the chemists classify as "colloidal," as they are microscopic and even submicroscopic in size) absorb and lose moisture slowly, at least at ordinary climatic temperatures. This makes it possible for gelatin to exist in almost any conceivable state between hard solidity and complete liquidity, including, to be sure, semi-liquidity or jelly.

This ability of gelatin to retain various degrees of moisture makes it an ideal carrier for the light-sensitive particles which make up our photographic emulsions. In its fully hydrated, or fluid state, it permits a thorough, even admixture of the photosensitive elements.

In the comparatively soft, porous state in which it appears in the raw film we put in our cameras, the gelatin is solid enough so it doesn't disturb the dispersal of the light-sensitive emulsion grains as the film is wound from the feed spool to the take-up spool of a camera. When you have the film processed, this same characteristic permits the developing and fixing chemicals, and the color-developers, to penetrate the emulsion freely, so that they do their work completely.

In the firmer state with which we are more familiar with photographic gelatin—the semi-hard state in which it appears on finished film—it does a remarkably good job of holding in place the millions of tiny silver-grains or (in color) dye-molecules, which as long as they're in their right places, compose our finished picture.

But at this point the softness and porosity which had been such advantages in gelatin, become disadvantages. The gelatin, in the ideal state, contains between 1/6 and 1/8 water. That is just exactly right to keep it at the best balance between pliability and strength. If it loses more moisture than this, it becomes brittle. If it picks up more moisture, it becomes soft, and very easily scratched. In fact, if the process of picking up added moisture is carried far enough, the gelatin will actually disintegrate. This porosity also encourages

defacement of the picture by oil, dirt and water spots, and by finger-marks.

The 'Pliability Reserve'

Luckily there are several methods by which film can be protected. It's quite a job, though, because to do a really good job, the protective treatment should safeguard it against such widely differing dangers as damage from climate, wear, scratches, oil, dirt, water and finger-marks. Adequate resistance to the heat of projection and lack of satisfactory atmospheric moisture requires maintenance of what the chemists call the "pliability reserve."

Resistance to such physical damage as scratches, excess atmospheric dampness, and oil, water and fingerprint stains requires a toughening or hardening of the emulsion's structure. Yet this last must be obtained without sacrifice of pliability—and both changes must be permanent, and unaffected by either continued use or the repeated cleaning which all good film should be given.

One very recent method is the one introduced a year or so ago by the Eastman engineers, which consists of applying a microscopically-thin coating of a special lacquer over the film's surface. This would appear to seal the emulsion in what the diplomats like to call the "status quo," and should tend to keep the moisture in the emulsion from getting out, or that which is outside from getting in.

It also seems to act like a coat of armor-plating: the lacquer-coating is thick enough to take the oil-marks and fingerprints and all but the deepest scratches without letting them penetrate to the emulsion. Then, when the film begins to show wear, I understand the lacquer can be removed, and a new coating applied, so that the net result is virtually a new print.

However, there's one practical question I haven't yet seen answered in any discussion of this method: whether or not it also seals the edges of the emulsion-layer. This is important, for moisture can work in and out edgewise, as well as through the surface of the emulsion; there are some operations in Kodachrome processing, I believe, in which certain layers of emulsion are developed or colored just that way—by penetration through the edges.

The 'Vaporate' Process

Another very popular and technically unique method of protecting film is by the well-known Vaporate process. In this, various chemicals, each of which serves a particular function in protecting the film, are introduced in proper sequence, while the film is kept in a vacuum.

Screen Shortage a 'Myth' Says Vocalite Company

Characterizing recent pronouncements of a severe shortage of motion picture screens as "a myth," officials of Vocalite Screen Corp. (Roosevelt, L. I., N. Y.) state that "intimate contact with the present status of screen manufacture and sales of screens to various circuit and independent theatres belie reports of a critical shortage of screens". Stating that recurring statements of screen shortages are useful only as "scare copy" in an effort to spur sales, the Vocalite people assert that there is a shortage only in certain special types of screens.

"We anticipate no difficulty in filling our normal quota of orders" was the closing advice in the Vocalite statement.

In this process, the first step is to introduce a chemical which displaces the easily-lost water content of the gelatin particles, and substitutes an inner lubrication which gives the necessary inner resiliency. This protects the emulsion against heat and brittleness.

The next operation introduces chemicals which toughen the surface of the gelatin particles to seal in this inner lubrication, and to seal out unwanted water, oil, dirt and finger-marks. It also tends to provide protection against scratches and abrasions, against water damage in accidents, floods and fires, and against mildew and other bacteriological deterioration.

The next step after this is the introduction of further chemicals which lubricate the outer surfaces of the gelatin particles, *after* the surface has been sealed to keep the inner lubrication where it is needed, and toughened to resist wear and abrasion. This outer lubrication is quite distinct from the inner lubrication. It eases the passage of the film through the projector, and lessens the mechanical strain on the perforations.

All of this treatment would be of relatively little use if there were not some method of keeping the various protective chemicals where they belong. In this direction, the Vaporate treatment is, I think, particularly ingenious.

The various protective chemicals are introduced in a vacuum. They actually enter the treating-chamber as liquids, but with the release of pressure, they turn to gas or vapor, and can penetrate freely.

The same basic principle is used to keep them where they belong. Air pressure is introduced after the treating is complete—the normal 14 lbs. per square inch which surrounds all of us normally. And this normal air-pressure serves as a policeman to keep the preservative chemicals in the emulsion, and to keep cleaning-fluid, water, and normal atmospheric moisture from seeping in and destroying their effectiveness.

The Celluloid Base

In all of this, however, we've considered only one side of the film—the emulsion. Ordinarily, we think of the emulsion as being the tenderest side of the film. But a number of engineers like Hartley Harrison, who studied the question rather thoroughly, point out that the celluloid base of the film is much more subject to abrasion than most of us give it credit for. You can check up on this easily enough by inspecting both sides of a strip of abraded film through a magnifying-glass. You'll be surprised how many of the scratches appear to be on the celluoid side of the film!

Probably the best protection from film-base scratches is to have the film lacquered on that side. This should protect the base from most scratches, and the coating can be removed and replaced whenever the film begins to show wear. With Vaporate or a similar coating on the emulsion-side, and a good lacquer-coating on the film-base side, the film should be amply protected against most normal wear and tear.

GOVT. OFFERS TO PURCHASE PRIVATE 16 MM. OUTFITS

Owners of 1939, 1940 and 1941 model sound projectors for the showing of 16 millimeter motion picture films are being asked by the War Production Board to offer them for sale to the Government. These machines are essential for the rapid teaching of the armed forces and defense workers. Due to the present aluminum shortage, production of new projectors, which requires the use of an aluminum casting, is being curtailed.

Approximately 35,000 16-millimeter sound projectors were manufactured in 1939, 1940 and 1941 and sold for various purposes. Many of the purchasers were large corporations, such as automobile companies, which used the machines for sales promotion.

Any individual, business organization or school owning such machines is requested to write to the W.P.B., stating the number of machines he owns, how many he is using for defense training and how many he is willing to sell, the year model or models, and what price he is asking for them. Letters should be addressed to M. D. Moore, Electrical Appliances and Consumers' Durable Goods Branch, War Production Board, Washington, D. C.

The W.P.B. will not itself buy the machines but will transmit the information to the War and Navy or other government departments, which can then buy the machines they need.

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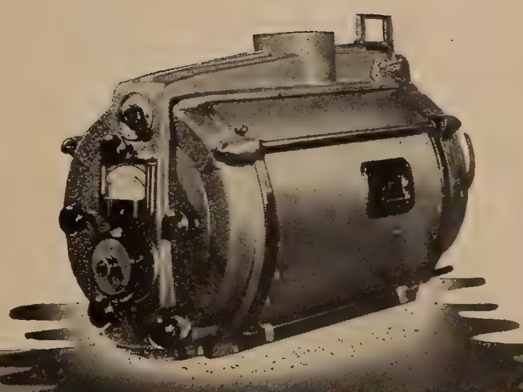

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THERE'S A BRANCH NEAR YOU

Control-Track For Better Sound

IT IS well established that the sound-on-film medium that has been employed since the inception of sound pictures has a limited volume range which is incapable of reproducing in the theatre without external aids the range of sound intensities picked up in the recording process. While the recent introduction of fine-grain film has increased the basic signal-to-noise ratio by several decibels, the increased volume range thus obtained still is far short of meeting the volume range requirements of modern sound pictures. It still is necessary to expand the volume range by using devices such as noise reduction.

In the variable-density method of recording both squeeze-track and printer-light variation are used to expand the volume range further. Experience has shown that by judicious use of these three technics approximately 20 db may be added to the range which is obtained from a sound record made without employing any of these devices.

It has been found that even when these technics are employed the volume range still is insufficient for correct reproduction of extremely loud sounds often required to enhance the dramatic presentation of a sound picture, and the resort to overloading of the light-valve is only too common a practice in such situations.

To remedy this situation the use of a control-track has been suggested which would produce an automatic change in gain in the reproducing system and which would make it possible to reproduce in the theatre a range of sound volume comparable to that originally existing on the sound-recording stage. The use of such a control-track makes it possible to eliminate some of the aforementioned technics, especially squeeze-track and printer-light control, and thereby simplifies the operations necessary for producing the enhanced volume range in the theatre.

Various Positions Suggested

Proposals have been made from time to time for a control-track located on various parts of the movietone print, such as the area between adjacent sprocket-holes, currently employed in the Vitasound System.[1] It has also been suggested that the area outside the sprocket-holes on the sound-track side of the print be employed for control-track purposes.

The control-track located in the sprocket-hole area is open to several objections. For example, the presence of 96 cycles and its numerous harmonics limits the use of this area to control frequencies well below 96 cps. This permits ordinary manual operation of the controls but prevents the use of any automatic control that might follow the sound envelope frequencies.

It is difficult to superimpose multi-channel control frequencies on the sprocket-hole track due to the narrow frequency range available below 96 cycles. It is also difficult to record and scan this track in line with the sound-track, thereby requiring separate recording, printing, and reproducing apertures.

The location of the sound-track outside the sprocket-holes is also subject to several objections, such as the presence of footage marks and other printed information, the liability to wear and tear, and the accumulation of oil and other dirt which might interfere with the proper functioning of the track in this area. It requires also, in common with the control-track in the sprocket-hole areas, the addition of separate recording, printing, and scanning apertures.

An examination of a Movietone print shows that there is an unused area 0.029 inch wide between the inner edge of a standard 76-mil sound-track and the outer edge of the picture frame. Allowing for an 84-mil scanning aperture in the theatre reproducing equipment, which overlaps the 76-mil track by 4 mils on either side, there remains an effectively unused area of 0.025 inch between the scanning aperture and the picture.

The control-track herein described is located in this area, having the dimensions shown in Fig. 1. The 5-mil width of the control-track was selected only after tests had shown that the output from such a track was ample for all intended operations. The location of 16 mils from the sound-track and 8 mils from the picture area was chosen with due regard to established tolerances in printing and reproducing machines.

It will be noted that a scanning aperture 105 mils wide is required for proper scanning of the sound and control-tracks. It will also be noted that the sound-track is symmetrically placed between the narrow control-track and the sprocket-holes and is located in the standard position on the film, thereby permitting playing in a theatre not equipped for control-track reproduction.

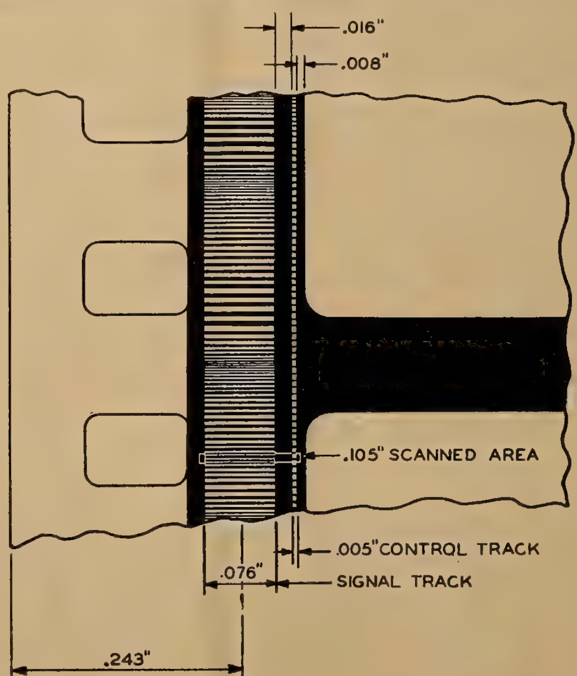

FIGURE 1

The control track suggested as a means to increase the range of sound volume and simplifying the method of obtaining maximum results.

[1] I. P. for October, 1941, p. 14.

Amplitude Modulated Track

In the first attempt to use a control-track in this area, a single control-frequency was recorded, the amplitude being varied manually in the recording process in accordance with the sound level desired from the print. Various single frequencies, ranging from 7000 cycles down to 1000 cycles, were employed at different times, the use of any frequency within this range permitting so-called "fast" operation of the control-track.

In reproduction the 5-mil control-track was scanned by a separate photo-electric cell placed in the sound-head, and the output fed into a specially designed logarithmic amplifier. The output from this amplifier was rectified, filtered, and the resulting voltage applied to a variable-gain stage of amplification in the signal channel.

Since the signal-to-noise ratio of a 5-mil track is approximately 23 db lower than on a 76-mil track, it was necessary to pass the control-signal through a narrow band-pass filter to secure a sufficiently high signal-to-noise ratio. With a band-pass of ±250 cycles, a signal-to-noise ratio of 38 db was obtained which was ample for a 30-db range of volume control.

The chief objection to the use of an amplitude-modulated control-track is that the amount of expansion is subject to variations in the output of the control-track photocell, which may be caused by fluctuations in sound-track density, reproducing-lamp intensity, or photocell sensitivity. The amount of expansion is, of course, subject also to accumulation of dirt and scratches on the control-track which tend to vary the transmission of the track.

The control frequency is also subject to modulation at a 24-cycle rate by the "burn-over" of the adjacent frame lines. While this effect can be eliminated by insertion of a suitable filter, the operating time must necessarily be limited to values greater than one twenty-fourth of a second. It also requires the construction of rather complicated control amplifying equipment, the characteristics of which depend to some extent on the characteristics of the particular vacuum-tubes employed.

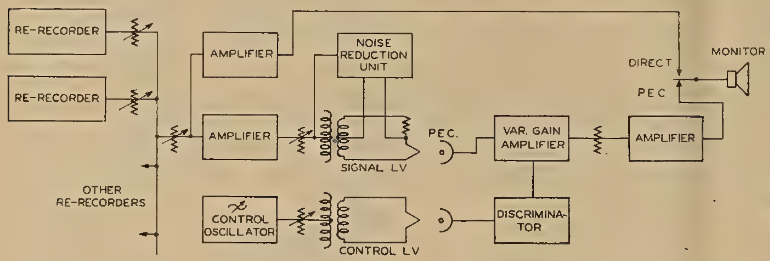

FIGURE 2 *Re-recording and monitoring system.*

Frequency Modulated Track

For these reasons it was decided to apply the principle of frequency-modulation to the control-track. In this case the frequency to be recorded on the control-track is varied, the amplitude being kept constant, the changing frequency in turn producing the desired changes in loudness of the reproduced sound.

In the reproducing equipment, the frequency variations are converted to amplitude variations by the use of a suitable discriminating network, the rectified output of which is again employed to change the bias in the variable-gain stage of amplification in the reproducing signal channel.

Experience with this type of control-track has shown that it is not subject to any of the limitations previously found for the amplitude-modulated track and that it tends to be much more reliable under theatre operating conditions.

Since the control-track is intended for use on the release print, it is recorded during the dubbing operations on the release negatives. An *RA*-1061 push-pull type light-valve is employed to record simultaneously both signal and control-tracks. The signal is applied to one pair of ribbons and is recorded as a standard 76-mil sound-track, while the second pair of ribbons with suitable masking in the pole-pieces is used to lay down the 5-mil control-track.

The various individual tracks are mixed in the usual manner to maintain the proper balance between music, dialog, and sound effects, and ample modulations of the light-valve without overload should be maintained irrespective of the resulting sound volume.

The enhanced sound volume, which is heard directly over the expanded PEC monitoring system, is controlled by varying the frequency impressed on the control-track. The frequency is determined by varying the resistance elements of a variable-frequency oscillator which is located in the mixing console. Provision is made for either direct monitoring of the unexpanded signal being recorded or of PEC monitoring of the expanded signal that will later be reproduced from a control-track print.

The control-track may be used either to enhance the volume of loud sounds which normally are compressed due to the limited volume range of the film medium, or may be used at the other end of the sound-intensity scale to reduce the background noise of the film. Thus, instead of recording low-level passages, as is customary at a low per cent modulation of the light-valve, these passages may be recorded up to nearly top level, and the proper sound balance restored by using the control-track to reduce in proportion the gain of the reproducing channel.

In practice it has been found that with a total of 30 db of volume-control range in the reproducing system, the top 20 db of this range may be successfully employed for expansion of loud musical passages and sound effects, normal dialog level being recorded at the 10-db expansion level.

To permit increasing the film modulation for low-level passages, the lower 10-db range of the control-track may be

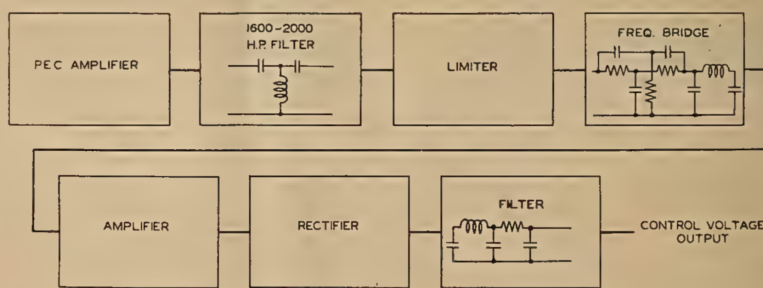

FIGURE 3 *Discriminator Unit.*

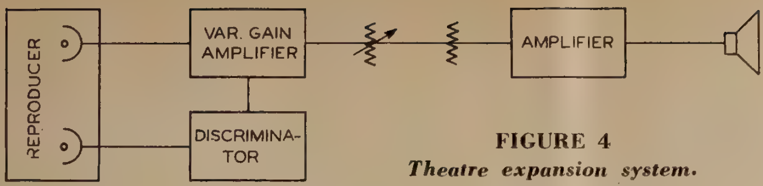

FIGURE 4
Theatre expansion system.

utilized. Thus, it seems feasible not only to expand the louder sounds by as much as 20 db but effectively to reduce background noise during low-level passages by as much as 10 db by the automatic reduction in gain of the reproducing system by this amount through the operation of the control-track.

Recording Process Data

Since the circuits used for monitoring the expanded volume range in the re-recording operation are identical with those intended for reproducing the control-track film in the theatre, it is only necessary to explain their operation in the former process. A diagram of the re-recording and monitoring layout is shown in Fig. 2.

The outputs from the various re-recording machines are mixed as usual into a single sound channel shown in the drawing. The resulting signal frequencies are amplified and applied to one pair of ribbons in the *RA*-1061 valve in the customary manner. Simultaneously the control-frequency generated by a variable-frequency oscillator is applied to the second pair of ribbons of the light-valve. This oscillator may be any one of a variety of oscillators provided that the oscillator used is of such nature that simple controls may be utilized to vary the output of the oscillator from 2000 to 4000 cycles.

By means of the double PEC monitoring arrangement shown in Fig. 2, the control-track signal is picked up by the second photocell and fed to the discriminator unit shown in Fig. 3.

The output of the control-track is first amplified and then transmitted through a high-pass filter to prevent all extraneous frequencies below the lower 2000-cycle limit from affecting the operation of the frequency-discriminating circuit. The control-signal is next passed through a limiting amplifier employing grid and plate saturation, this limiting action being necessary to insure that the voltage input to the bridge circuit is constant and independent of frequency. This bridge is balanced at 4000 cycles and serves as a frequency discriminator to convert the frequency variations to voltage variations.

The loss at the balance frequency amounts to 67 db. This so reduces the output in the operating region that 45 db of gain is required to obtain the necessary voltage for application to the control grids of the variable-mu tubes in the variable-gain stage in the signal channel. The output of the amplifier is rectified and then transmitted through a combined. low-pass and R. C. filter to prevent noise and extraneous frequencies above the balance point from being transmitted to the signal channel.

The output of the signal circuit is fed first into two stages of a resistance-coupled amplifier. The push-pull variable-gain stage follows the preamplifier. The gain of this stage is controlled by the biasing voltage applied to the variable-mu tubes from the control-track circuit described above. This bias is fed through a balanced-bridge circuit to the control-grids in order to eliminate any residual ripple which may have been transmitted through the filter in the discriminator.

In order to permit the use of this amplifier for the reproduction of standard sound-films, provision is made to switch in a fixed bias in the variable-mu stage to replace the biasing voltage supplied from the control-track.

Theatre Reproducing Data

Since it has been pointed out that the circuits employed in the reproducing and monitoring operations are identical, it will be unnecessary to explain further the operation of the theatre expansion equipment, a schematic diagram of which is shown in Fig. 4. The use of identical monitoring and theatre reproduction circuits insures that the sound reproduced from the control-track print will have the same degree of expansion as that heard in the monitor during the re-recording process.

Certain modifications are, of course, required in the sound-head for proper reproduction of the control-track. For example, the scanning aperture must be widened from the present 84-mil standard to the proposed width of 105 mils. This may be accomplished by widening the physical slit in the reproducing lens system or by increasing the magnification of the objective lens in optical system. Figure 5 shows the modifications to a standard Western Electric TA-7400 necessary for proper reproduction of the control-track. It will be noted that the light transmitted by the sound and control-tracks is separated into two distinct beams by two abutting lenses, the individual beams being transmitted to the active surfaces of two separate photocells, or the separate surfaces of a push-pull type of cell.

If the latter technic is employed, special balancing PEC coupling circuits must be employed to reduce cross-talk between the signal and control-tracks. In certain types of sound-heads, where it might be difficult to mount an additional cell, the use of the push-pull PEC and associated balance circuits is probably indicated. The PEC output from the two tracks is fed over two separate coaxial cables to the special amplifying equipment previously described.

The preamplifier preceding the variable-gain stage may not be necessary in many theatres having modern single or two-stage pre-amplifiers operating from cable connections from the photocells located in the sound-heads. While the actual physical design and room location of the special reproducer equipment can not be specified exactly at this time, the circuits employed will undoubtedly be quite similar to those that have been described above.

In reproducing the sound-track in theatres which have not been equipped for reproduction of the control-track, some difficulty may be encountered from audible reproduction of the control frequencies over the theatre horn system. This can usually be prevented by readjusting the position of the scanning slit.

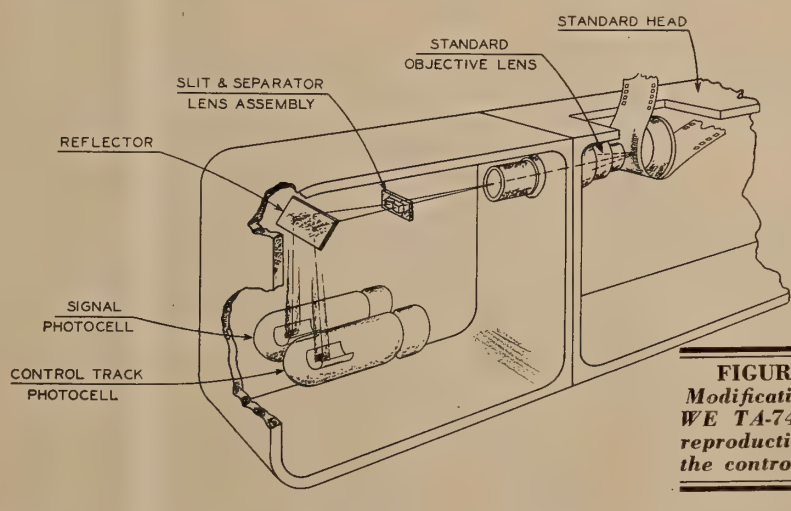

FIGURE 5
Modifications in WE TA-7400 for reproduction of the control track.

However, in the case of some of the older optical systems, it may be necessary to insert a mask at the scanning slit to prevent partial scanning of the control-track by the light-beam. In theatres employing modern optical systems, there should be no difficulty, provided the lens system is in proper adjustment.

While the use of a single frequency-modulated control channel has been described here, consideration has also been given to the use of multiple channels superimposed on the same 5-mil track. It has been found that three channels each capable of approximately 30-db expansion and suitable for high-speed operation may be accommodated. The number of channels may be increased almost indefinitely if band width and time of operation are not limiting factors.

These multiple channels may be used to control the outputs of multiple tracks intended for stereophonic or similar purposes, or they may be used, if desired, to switch music or sound effects to multiple horns or for other similar operations intended to add more realism to the screen.

Recording Results O.K.

The use of this control-track has, to date, been limited to experimental re-recordings of sequences at Universal and Samuel Goldwyn Studios, and the re-recording of a 2-reel musical short at Universal, which is intended for demonstration at the Pantages Theatre in Hollywood.

In none of these tests was it found desirable to use less than about 12-db of expansion to secure the proper range of sound volume from the print. In others it was found desirable to use the full 30db range. This was particularly true in the re-recording of a dive-bombing sequence in the picture, *The Long Voyage Home*, in which the top gain was required for proper reproduction of the bomb bursts, and 30-db less gain was required for proper rendition of low-level background music passages.

The fact that these extremely loud sounds can be recorded without overloading the light-valve makes possible their reproduction with a degree of naturalness and realism which heretofore could not be obtained on account of the excess distortion incurred from overload of modulator and film.

It has been found that a 5-mil frequency-modulated control-track recorded between the present sound-track and picture area on the release negative may be used to add 30-db of volume range to existing sound-films. It has also been found that with this device it is no longer necessary to use squeeze-track or printer-light control methods to extend the volume range of variable-density sound-films.

The control-track may be recorded in such a manner that a part of the gain change, the upper 20-db, for example, may be employed to enhance the volume of the louder sounds, while the lower 10-db may be used to reduce the gain during the quieter passages; thus adding effectively to the noise reduction during these interals.

The use of the control-track in the area specified is not limited to any particular operating speed nor is it limited to the operation of a single sound channel, but may be used also to provide controls for multiple sound-tracks. In addition, it may be used for various other types of control operations associated with reproduction of sound-films. Standard sound-films may be reproduced in theatres equipped for control-track by simply switching in a fixed bias in the variable-gain stage amplifier, and control-track films may be played as standard tracks in unmodified theatres.

Experience to date with the use of this track has shown that it may be used very effectively not only to enhance the realism of high-level sounds, but to add much to the dramatic qualities of low-level passages where the usual presence of background noise detracts from the scene being portrayed.

Discussion:

Mr. Palmer: Does the use of this proposed control-track involve the addition of new amplifying equipment in the theatres?

Dr. Frayne: In addition to the modifications of the soundheads outlined in the paper, the only change contemplated in theatre equipment for proper reproduction of the control-track is the addition, if necessary, of sufficient amplifier capacity to provide proper reproduction of the louder passages.

Mr. Kellogg: The criticism has been made of any system depending upon changing amplitude of a fixed frequency that it would be susceptible to undesired changes due to variations in exciter lamp brightness and photocell sensitivity (including effect of variations in polarizing voltage). I should like to call attention to the fact that this problem was early considered by H. I. Reiskind who handled most of the development work on the sprocket-hole control-track for us [RCA].

Following a suggestion of Frank Sheppard, he worked out what has proved to be a very satisfactory way of overcoming this difficulty. Making use of the logarithmic relation between plate current and grid voltage when an amplifier tube is worked in a certain range, he caused the average photocell current to chance the amplification so that the 96-cycle output of the tube depended upon the percentage modulation of the transmitted light and was scarcely affected by a change in average brightness of the source, or photocell sensitivity. This work was reported in Mr. Reiskind's paper on "Multiple Speaker Systems" [I. P. for Oct., 1941].

Mr. Farnham: Is the picture area affected by the use of the control-track?

Dr. Frayne: The use of the control-track described in this paper does not call for any change in standard picture or sound-track areas.

ALTEC TO SERVICE 154 INTER-STATE CIRCUIT THEATRES

Interstate Circuit, Inc., whose 154 theatres constitute the largest chain of theatres in Texas, has appointed Altec Service to handle sound and projection equipment servicing for the chain. Appointment of Altec is described as a move toward intensified conservation of war-needed materials, as well as recognition of Interstate's increasing responsibility as an entertainment medium in the fastest growing military and war-industries section of the country.

MATERIALS SAVED BY RCA GO FOR WAR PRODUCTION

Tons of metals and chemicals desperately needed for the United States war production program are among the strategic materials conserved by an all-embracing program worked out by development engineers of RCA. The program antedates by many months Government restrictions on radio production to save needed materials. In addition to discovering alternate materials—and then alternates for the alternate materials—RCA engineers have also been able to develop domestic alternates for imported materials, thus freeing shipping space for other commodities.

HOLLAND TO NEW ORLEANS

A. C. Holland, RCA Photophone engineer who has been located in Memphis, Tenn., for the past several years, has been transferred to New Orleans, where he is headquartering at the Jung Hotel.

OLD DEBBIL PRIORITIES

If you think you've had headaches in the past, just wait until you get "priorities" slammed at you from all sides. Up to now when you needed a part for your machine you simply ordered it and that was that.

Those days have gone for duration. Old debbil priorities is gonna get you. It's going to take all of the well known Yank ingenuity to keep machines running, but we're betting on the man in the booth to overcome any handicaps that priorities may toss in his way.

Color Television In England

By *J. H. BAIRD*

BAIRD TELEVISION, LIMITED

WHEN war broke out, television in England was firmly established and appeared to be entering upon a period of prosperity long delayed. Preparations were in hand to meet a large and rapidly growing demand for televisors both for the home and the theatre. With the outbreak of war television transmission service was immediately stopped, and the results to the growing industry were catastrophic. With no transmissions available, receiving sets were useless and commercial television came to an abrupt standstill.

The company of which I was president (Baird Television, Ltd.), one of the worst sufferers, was unable to continue. At that period I was engaged on research in color television, work which I have continued in private during the war.

The transmission of television in color is not new: it was shown for the first time in public as far back as 1928, when I gave a demonstration at the annual meeting of the British Association. The demonstration was entirely experimental, but the principle then shown is the same as that used in the latest apparatus.

It is, in fact, a process similar to color printing, three images corresponding to the three primary colors (red, green and blue) being superimposed. In the first color television apparatus the three colored images were obtained from a disc perforated with three spirals of holes, one spiral being covered with a red filter, the other with a green, the third with a blue; and the three pictures so produced were superimposed to form an image in natural colors.

12 x 9 Ft. Televised Image

The picture then shown was very small, only a few inches square and of poor quality. Development since that date has been slow, since general attention has been largely centered on monochrome. At last in 1938 I was able to show a 12 ft. by 9 ft. color television picture transmitted by wireless from the Crystal Palace to an audience of 3,000 in the Dominion Theatre. The apparatus used, however, was costly and complex and not practicable for the home.

Immediately before the outbreak of the war, in August 1939, I was able to show color television for the home by using a rotating disc fitted with color filters in front of the ordinary cathode-ray tube of the present-day home receiver. In our latest apparatus the number of lines has been increased to 600, giving nearly twice the amount of detail available on the British Broadcasting Company's black-and-white pictures.

Both three-color and two-color processes have been experimented with. For practical purposes the two-color has much to recommend it at present and in our latest apparatus a two-color process is used in conjunction with a special form of scanning, a triple-interlaced 200-line primary field being employed, alternate fields passing through red and blue filters giving a final 600-line picture in color.

The complete field is scanned 16 2/3 times per second, and complete colored pictures are transmitted at the rate of 8 1/3 per second. With triple interlacing and alternate primary scans colored, this very low picture frequency can be used without undue flicker and with the very great advantage that the 600-line color picture can be transmitted on the same wave-band as that used by the B. B. C. for their 405-line black-and-white transmission.

The use of two colors in place of three simply means substituting a two-color disc for a three-color one. It entails a loss in color rendering, but, if three colors are used, a much wider channel is necessary for transmission, and considerable alterations in existing apparatus are required.

Two-Color Image at Start

We are experimenting with both three and two-color, but for practical working the use of two colors has many advantages, and commercial color television will probably commence with a two-color system which is immediately adaptable to existing apparatus and available channels.

After the war the broadcasting of color television will, I feel sure, be one of the major television developments. The colored television picture is far superior to the monochrome, and sooner or later must supersede it. As far as Britain is concerned, the television service will be extended to cover the whole country instead of being confined to the London area. Theatres will be equipped with television screens and television will become a regular feature of their programs.

The importance of the television service is well recognized today and we may look forward to its early resumption as one of the first post-war developments.

RCA MAKES MOVIE HORN OF WOOD TO SAVE STEEL

A new 12-cell, high-frequency horn made entirely of wood, except for the throat, has been announced by RCA Photophone for use in motion picture sound reproducing systems in theatres. By substituting wood for the steel formerly used to make the unit, much metal is saved for more important uses in the defense program, while efficiency of the horn is not impaired.

The new horn, which is mounted atop the larger low-frequency horn as was its metal predecessor, has been thoroughly tested in the Indianapolis laboratories of RCA, and in the Camden plant, where it was put through full-fledged operating tests in a theatre-sized auditorium.

This dubbed-in photo shows how 1,200 people watched Billy Soose win the middleweight championship from Ken Overlin, on a 15 by 20 foot screen at the New Yorker theatre at the same time the action was taking place at Madison Square Garden, four blocks away. The occasion was the World's Preview showing of large-screen theatre television sponsored by RCA.

Projectionettes Take Over

THE absorption of man-power into the British Armed Forces has meant acute shortage in the ranks of men projectionists, who are not reserved unless they are chief projectionists or in the over-35 age groups—which few of them are.

This shortage has led to the inevitable inclusion of women into what was formerly a jealousy-guarded, masculine field of film work. At first, chief projectionists were extremely doubtful whether women, never renowned for possessing mechanical minds, could be trained to take charge of a projection machine and operate it off without supervision, much less deal with any faults that might occur in the film or the equipment.

One chief projectionist of many years' experience—an original member of the British Guild of Projectionists—foresaw the shortage of men as far back as September of last year. Being averse to the employment of women he put forward a suggestion to the Cinematograph Exhibitors Association that boys of school-leaving age, too young to be called up for military service, but with definite electrical or mechanical inclinations, should be trained as projectionists.

This, however, came to nothing, and the men in charge of projection rooms soon found themselves faced with the problem of either doing without an adequate staff or training women to assist them.

Show Surprising Aptitude

Gaumont British (theatre circuit) instituted a system of training women in theatres which had been put out of general use by enemy action, and some individual chief projectionists actually took women into their projection rooms and themselves set to work to train them.

The results have been markedly successful. It is now generally admitted that women have shown a surprising aptitude for work which was formerly considered beyond their capacity. Nevertheless, chief projectionists are not yet "sold" on the idea of leaving two women alone in control of a projection room without the benevolent supervision of a man to give them a helping hand if "anything goes wrong."

Which means, briefly, that women have been proved wholly capable of setting up and operating the machines, and coping with the changeovers, but considerable technical training still will be necessary before they are qualified to deal with such unpleasant possibilities as breakdowns even though service engineers are standing by all day in case of extreme difficulty.

Cinemas in the West End of London already employ about half a dozen women in their projection rooms. Two of them are at the Carlton, the Paramount theatre in the Haymarket, under the tutelage of Mr. Burke, the chief projectionist.

Typical of many thousands of other women in this war, these two girls took up work strange to them because they knew that in this way they could release men whose technical qualifications would be of immense use in the armed forces of Britain.

Dual Purpose in Work

Mary Hanifan, of Kennington, a suburb of London, is a bright-eyed, clear-complexioned brunette who has been deeply interested in films for at least seven of her twenty-one years. Not just from the onlooker's point of view, either. For six years Mary worked "in films": two years with Fox Films to learn the job of film repairing, and four years with Warner Brothers doing that job, and doing it well.

Came the war. One day Mary heard that girls might be taken on as trainees in projecting rooms. Here was something more to learn. Something a lot more interesting than her repairing work. Something with a future. Mary was on to it in a flash. Films were her job, and if there was anything more she could learn about them, she was going to know it. Most important of all, her "boy" in the R.A.F. had impressed on her the necessity of releasing men for the Forces, and she knew that this would be pretty important war work.

So Mary applied at the Plaza, another of Paramount's theatres. She was interviewed, approved, and sent round to Mr. Burke at the Carlton. He talked to her, was impressed by her interest in films, her eagerness to know more. He took her on and set himself to train her on a spare machine in his projection room, letting her do her worst with an old film, explaining, encouraging, with infinite patience.

Mary's "worst" was a pretty good best. In three weeks she was O.K., qualified to set up the projector, operate it and changeover, direct to the audience. She was able to relieve a man for other important work. In short she was a projectionist, one of the first women in Britain to undertake the work.

Today she goes on duty at 9:45 a.m., working from 10:30 a.m. till 6 p.m., with an hour for lunch. There is always an experienced man within call in case she gets into difficulty; thus far she hasn't. She knows what she is doing, and does it efficiently. Now she is getting interested in highly technical questions.

Co-projectionist with Mary at the Carlton is Valerie Canton, a petite, pretty blonde, formerly a showgirl by profession. Her interest in movies started when she did crowd work in various films. She began to learn something about the technical side; then she got interested in photography; finally, and surprisingly, her own wireless (radio) began to intrigue her to the extent that she enjoyed taking it to bits and putting it together again—and making it work, at that.

The above scene is not an American booth but in England where women are rapidly taking over the work of men projectionists and doing a noble job, according to the Ministry of Labor. This same scene may be duplicated in this country before the end of the war.

Conservation, New Technique, Highlight Altec Service Managers' Conference

THE increasingly urgent need for conservation of essential materials used in projection rooms, and the intensive development of service maintenance methods as an integral part of the theatre conservation program, were the highlighted theme of the nation-wide Altec Service managers' conference held recently in N. Y. City. In opening the conference, L. W. Conrow, president of Altec, said:

"As a result of foresighted preparations, commenced well over a year ago in anticipation of just this scarcity situation, your organization's research activities, both in the technical and commercial fields, have made you completely prepared to assume the new responsibilities which exhibitors are now anxious for you to assume.

"Whereas in the past, your service organization has been essential in keeping the quality of sound in the theatre at its highest possible efficiency, you are now called on to help the exhibitor in the performance of a two-fold patriotic duty.

"The first, obviously, is the purveying of satisfying entertainment as an essential factor of public morale. The second, however, is the conservation of essential materials used in the projection rooms, which the government urgently needs to have conserved. The complete preparedness of our organization to help the exhibitor make projection and sound mechanisms and parts operate at their highest efficiency level through their entire service life, makes our engineers an essential factor in the exhibitor's present-day performance of this patriotic duty."

The Long Grind Ahead

Speaking on the theme "There is a long grind ahead for your sound and projection equipment", G. L. Carrington, vice-president and general manager, told the managers how Altec, working in continuous contact with government agencies responsible for allocations of materials, has anticipated the need for, and has developed, a widely diversified source of supplies for parts absolutely needed in projection rooms, and explained how this problem of supply has been related to the special localized needs of exhibitors in all parts of the country.

Present at the conference, in addition to Messrs. Conrow and Carrington, were: H. M. Bessey, secretary-treasurer; E. Z. Walters, comptroller; R. Hilton, L. J. Hacking, F. C. Dickely, B. W. Ardell, E. O. Wilschke, P. F. Thomas, A. J. Rademacher, D. A. Peterson, W. W. Simons, B. Sanford, M. G. Thomas, H. Wengler, H. S. Morris, A. L. Rubinstein, T. H. Carpenter, A. Fiore, D. L. Turner, W. Conner, S. M. Pariseau, S. W. Hand, H. B. Moog, J. B. Lansing, R. C. Gray, G. E. Wiltse, C. S. Perkins, E. C. Shriver.

KEEP all projection room equipment clean. Dirt and dust on equipment combine with excess oil, grease and air moisture to increase wear and maintenance. Clean equipment lasts longer and needs fewer replacements. Moreover, electrical and mechanical failures are reduced, if not eliminated, in clean projection rooms.

Use the specified grade and quantities of oil or grease according to the manufacturer's instructions. Oil or grease that is too heavy or too light will not lubricate properly. Equipment that is properly lubricated lasts longer.

Never lubricate equipment while in operation. Not only is there danger of getting the oil can caught in the gears, but excess oil will be spattered around. The oil level in the intermittent should be maintained at the "oil level" mark.

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IT *MUST* SPARKLE

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Do not fill above this mark as the excess oil will be thrown out.

All gears in the projector and sound mechanisms, not otherwise lubricated, should have a few drops of oil applied occasionally. Rotate the projector by hand to distribute the oil. Pad rollers should be lubricated so that they are free to rotate to avoid flat spots.

Equipment Adjustment

Never turn the projector by the shutter shaft knob. This will damage the gears. Always turn the projector by the motor knob or flywheel.

Be sure all switches are off when the show is over. Leave all pad rollers, lateral guide roller and film gate open when the projector or sound mechanism is not in use or threaded, to avoid flat spots in the lateral guide roller, weakening of the film gate tension and possible damage if the projector is accidentally started.

Watch all equipment carefully and maintain the proper adjustments. If in doubt as to the proper adjustment procedure, consult the dealer from whom the equipment was purchased. Improper adjustments will shorten equipment life and increase replacements.

Inspect and clean all film before running. Re-splice any weak splices and treat film tears properly. Weak splices and torn film may result in damaged film, if run through the projector. Oil on film picks up dust and dirt and contributes to scratching.

Watch film loops in both projector and sound mechanisms. Large loops cause film slap and film damage. Small loops cause unnatural bends in the film and excessive tension, resulting in torn sprocket holes and breakage.

Adjust pressure pads for the minimum pressure that will give a steady, sharp picture. Make adjustments carefully to prevent damage to parts.

Keep the gate, all sprockets, guide rollers and pad rollers clean and free of film emulsion. Dirt and emulsion on these parts increase film wear and possibility of film damage.

Inspect mechanism fire shutters for proper operation. Make adjustments carefully, and if in doubt, consult the dealer from whom the equipment was purchased. Properly operating fire shutters prevent fires and damage to equipment.

Keep clean and adjust for smooth take-up throughout the entire reel. Improper adjustment will result in film pile-up in the lower magazine or breakage.

Watch all sprockets carefully. Hooked sprockets tear film. Replace or reverse (if possible) all sprockets that are worn to the point where the film hangs on to the teeth.

Adjust all pad rollers carefully to rotate freely without excess end play. Adjust the clearance for two thicknesses of film.

Sound System Data

Some amplifiers require pre-heating of tubes. Leave switch in "Fil" position at least as long as specified by the equipment manufacturers. Never turn immediately to "plate"; otherwise immediate failure or shortened tube life will result. Operate all vacuum tubes in accordance with the equipment manufacturer's instructions. High or low voltage and high plate voltage and current decrease tube life.

Tubes that are microphonic or noisy in volume control amplifiers should be saved to try in power amplifiers. Save inoperative vacuum tubes for salvage purposes.

Inspect fuses, switches, busbars and wire connections. Tighten any loose connections and fuse clips. On knife switches keep contacts burnished; don't let pitting start. Loose connections and pitting cause heating and shorten the life of the equipment.

Lamphouse and Arc

Make sure that the lamphouse is kept thoroughly clean both inside and outside. The carbon ash, drippings, etc., should be removed regularly once a day, if required, especially from the shafts, bushings and gears of the arc control operating parts.

At least once a week, tighten up all electrical connections to the arc controls. Every day before the show, clean the mirror with soft tissue or a clean cloth. Do not turn the mirror around in its holder, as in a very short time the entire surface will be pitted. Check the mirror-retaining clips for the proper holding tension, for when they are too tight, it

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might cause cracking due to expansion.

If condensers are used, they should be cleaned before each show, and the retaining rings checked for proper holding tension.

All moving parts inside the lamphouse should be oiled slightly with light protection oil, but never over-oiled. The carbon jaw holders should be taken out at least once a week and thoroughly cleaned. For emergency use, an extra negative and positive jaw assembly should be on hand.

The arc control motor bearings should be oiled once a week with only a few drops of light oil, as over-oiling causes most failures. The arc control commutator should be cleaned at least once a month with a clean rag with a little vaseline applied to it. If the spaces between the commutator bars are "caked" with grit, use a tooth pick to remove the grit and then wipe the entire commutator perfectly dry.

The brushes in the arc control motor should be checked at least once a month and if they are wearing unevenly, or have rough hard spots, new brushes should be installed. Where the arc control gearing mechanism has packing boxes for grease, clean out the old grease at least once a month, and flush with kerosene, then repack with new grease.

The arc exhaust dampers and ducts from the lamphouses should be cleaned thoroughly of carbon ash, dust, etc., at least once every three months, because any blockage, no matter how small, will affect the proper burning of the carbons, cause pitting of the mirrors and produce a gradual accumulation of ash within the lamphouse.

Rectifier Operation Tips

Make sure that the rectifier is not operated above the recommended rating. Once a year, or oftener if necessary, raise the top section of the rectifier assembly and blow out accumulated dirt and lint in the rectifier stacks. This will insure proper ventilation and cooling. The ventilating fan in copper-oxide rectifiers requires periodic inspection and lubrication from one to two times a year.

See that the rectifier is located in a well-ventilated, cool spot. The flow of air through this equipment should not be restricted by being placed too close to other equipment or by placing material on top of the rectifier.

Make sure that the carbons and other lamp projection equipment are in proper operating adjustment so that excessive voltage or current is not required.

Check bulb sockets to make sure they are clean and not corroded or pitted. Sandpaper can be used to remove corrosion in order to make a good contact. Tighten bulbs in sockets securely. Check every few weeks as bulbs may become loose. Clean anode clip (connection at top of bulb) and connection to make certain of good contact. Replace clip connector, if corroded, or if clip has lost its tension.

Check power input to the rectifier to insure that the A.C. supply voltage corresponds to the transformer rating. Check filament voltage to make certain proper voltage is applied to the bulb. Voltages should be maintained as closely as possible to the recommended values. Variations of over 10% should be corrected.

In some cases, a slight increase in bulb life may be obtained, if filament power is turned on before load is applied. In other words, if 30 to 60 seconds leeway can be allowed, the filament will come up to operating temperature before it is called upon to furnish an output. This can be accomplished either by a switch or a time delay relay in the anode or plate circuit.

When replacing rectifier bulbs, always use the same type and capacity as recommended by the manufacturer.

Motor Generator Data

To get the most out of this equipment, remember that cleanliness is of the utmost importance. Keep commutators clean and remove all dirt before sparking becomes disastrous. Increased brush life as well as increased commutator life will be the direct result.

Check alignment of motor and generator shafts and keep couplings tight. Misalignment of shafts and loose couplings causes vibration, increased wear and parts replacements.

Dirty and arcing commutators cause heating and pitting, shortening their life and increasing maintenance costs. The contacting surface of each commutator brush should be periodically examined so that commutator and bearing wear is held to a minimum.

If the generator is on a concrete floor, particular care should be taken in sweeping so that abrasive dust from the concrete will not get into the bearings.

Oil bearing housings should be flushed out every six months and refilled with fresh oil of the proper grade. If a ball bearing motor generator has been out of service for a time, the bearing covers should be removed, the old grease cleaned out and replaced with new grease. All outside connections on ballast rheostats should be checked. Remove the cover from the rheostats periodically, and check the bolted connections to the resistor material.

Labor Secretary Perkins Points Out Labor Gains

A GREAT change has taken place in the status of American labor in recent years. The workers' right to organize into unions of their own choice and to engage freely in collective bargaining with their employers has now been firmly established. The right is guaranteed to them by the National Labor Relations Act, which has probably done more than any other statute to free labor from the fears of discrimination in employment because of membership in a union and to establish trade-unionism in the United States on a solid foundation.

It is now an established practice for government—Federal, State, and local—to consult with trade-union leaders and industrial management about matters affecting their interests in much the same way as it consults with farm, professional, and other groups. The advice of labor is sought not only on questions of wages and working conditions but also on broad social problems of our national life. In fact, trade-unionism in America has become a firmly established institution.

Many phases of the American pattern of life are conducted by institutions. Church bodies, bar and medical associations, banks and insurance companies, and stock and commodity exchanges are among such institutions. They are *private agencies* created for *private purposes or benefits*, but their activities are such that they touch upon the various economic and social aspects of the entire Nation.

Many of these institutions are greatly trusted by the people. Others have from time to time lost the people's confidence. Those that are trusted have generally imposed upon themselves certain rules and cretain disciplines, both in regard to the membership they serve directly and with regard to other groups and institutions. As long as they fulfill their responsibilities for the well-being of the Nation as a whole, they are permitted to conduct their private affairs freely and unhampered, without any attempt at legislation or regulation by law.

But when they fail to carry out their social duties, or for any reason lose the confidence of the people, some kind of regulation always follows. Thus, we have seen the regulation of the railroads by the Interstate Commerce Commission, the regulation of certain business practices by the Federal Trade Commission, and, more recently, the regulations of the

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stock and commodity exchanges by the Securities and Exchange Commission

A trade-union is a voluntary association of workers organized for the protection of the mutual interests of the membership. But the broad scope of activities which are now a part of the trade-union movement and which affect not only the membership of the particular union concerned but the welfare of all workers as well as of the Nation as a whole has placed upon trade-unions many of the same kinds of duties and responsibilities which fall upon other permanent American institutions.

The trade-union movement in the United States now enjoys many prerogatives and privileges, but at the same time it is also charged with definite social responsibilities. Unions are responsible not only for the welfare of the members of their organizations, but also for the welfare of all working people; for cooperation in the development and the prosperity of modern industry; for following sound economic, social, and political practices; and for the selection of leaders who are truated not only by the members but by employers, by government, and by all the people of the United States.

As an institution, the trade-union movement is constantly kept under what may be called social surveillance. Collective-bargaining procedures, strikes, trade-union functions, internal trade-union affairs and policies have become the subject of discussion in the press, on the radio, and in the open forum. The affairs of the unions have become to a large degree public property, and the actions and policies of the trade-unions are judged from the point of view of their effect upon the American people as a whole.

In other words, the public demands from the trade-union movement, as it always has demanded from other institutions, that certain standards, some of them very old and simple, be strictly and conscientiously observed. First and foremost, the public expects the utmost order and exemplary procedure in handling "other people's money." This means a scrupulous accounting for money and regular audits of all receipts and expenditures, including the handling of insurance funds, dues, and assessments. Such public accounting of union funds is met with greater approval when done on a voluntary basis by the unions themselves rather than under compulsory regulation.

With the trade-union basic rights protected by law, certainly no expenditures need be made by the unions except as

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they are authorized by the membership and for purposes which can be stated in the public accounting without embarrassment. Many unions have long followed this procedure of modern business methods, a policy which might well be followed by all labor organizations.

Labor's War Effort

In the present war emergency, labor has fully recognized its responsibility, which calls for cooperation with employers and with all other responsible groups to avoid delays and interruptions in defense work. Differences of opinion will always arise with regard to wages, hours, and working conditions, and even the status of trade-unions, but there now exists adequate machinery to handle and adjust industrial disputes without recourse to methods resulting in a stoppage of work.

Most important, there are the thousands of collective-bargaining agreements in which labor and the employer voluntarily agree to handle any dispute that may arise in the course of day-to-day operations through grievance committees especially created for this purpose. Many of these agreements also provide that disputes which cannot be solved within the framework of the agreement shall be submitted to an arbitration decision by an outside party.

Then there are the State conciliation and mediation agencies, and particularly the Conciliation Service of the Department of Labor, whose entire effort is directed toward helping labor and management solve their difficulties around the conference table. Its work is that of a sound, effective mediation service designed not only to adjust disputes when they occur but also, wherever possible, to prevent misunderstandings in labor relations from becoming industrial disputes.

Finally, there is the National War Labor Board, recently created by the President, to adjust labor-management disputes which cannot be settled either by the usual collective-bargaining procedure or with the aid of the Conciliation Service.

Within this framework of machinery established through collective bargaining and with the aid of the Government, labor and management should be able to solve any legitimate grievance that may arise, and at the same time develop the kind of united effort that is so vital in the successful prosecution and early termination of the war.

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INTERNATIONAL PROJECTIONIST

JANUARY 1942

VOLUME 17 • NUMBER 1

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Monthly Chat

Spring is here! How about going over your booth carefully and discarding all the accumulated junk you have gathered during the winter and if it is metal, particularly copper, sell it to the government.

There are probably pieces of useless junk cluttering the lockers. Get it out and eliminate fire hazards. It will pay you to clean house for it will give a cooler appearance as well as permit air to properly circulate.

The government needs almost every kind of refuse and you will be helping the cause by making your booth spic and span.

• • •

How long has it been since you took a complete look-see at your machine? That machine is going to require constant care for the duration for there will be few spare parts available due to priorities. You owe it to the machine to give it careful inspection at frequent intervals to prolong its life. The machines are your livelihood—keep 'em running.

• • •

The producers have agreed to use 16mm film for mobile units that will tour camps. The studios claim that they can have the smaller film ready for distribution within a month after the standard film has been shot.

This will mean less cumbersome setups of projectors upon arriving at camps and will save wear and tear on the tempers of the men assigned to the various units.

• • •

You fellows who have not been called to the colors can do your soldier friends a great service by writing them while they are working for Uncle Sam. Boys in camp get mighty lonesome and, as you men who served in the last shindig can well remember, how tough it was when the mail was dished out and you didn't click.

It's a little thing to do but means a heap to the fellow that's packing a gun. Tell him the gossip. Let him know how things are going in the booth. Let him know you're rooting for him, for a guy can get pretty blue in camp.

Send him the home town paper and IP. Pass the hat around headquarters and get him some cigarettes. Remember how you used to have to bum smokes before the ghost walked? Human nature hasn't changed and the boy in camp feels just as lonesome as you did, so get busy.

Conserve Copper

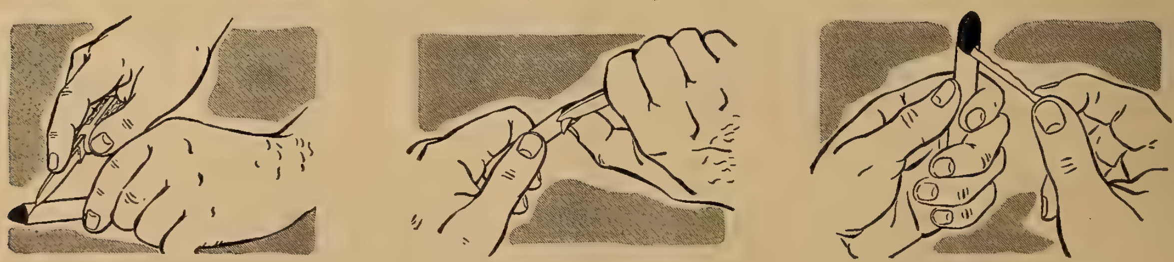
Your country needs copper to carry on the war!

Exhibitors and projectionists can give material aid to the nation's war effort by salvaging the copper from the stubs of used copper coated projector carbons and the copper drippings in projector lamp houses. Many are already rendering this commendable service.

Practically all of the copper used on projector carbons can be recovered with little effort. By the time you read this, our Government may require that this recovered copper be turned in by you to your distributor before additional copper coated carbons can be delivered to you.

Immediate and concerted action on the part of exhibitors, projectionists and carbon distributors throughout the country will result in conservation of most of the copper used on projector carbons. Otherwise, continued production of copper coated carbons may not be permitted.

How to Strip the Copper Plating from Carbon Stubs



1 Slit a short angular cut in the copper plating with knife.

2 Raise the copper plating at this slit with a knife blade.

3 Peel the plating off in a spiral with fingers.

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Correct Use of Amplifier Meter Will Assure Better Sound Results

BY LEROY CHADBOURNE

The tube meter with which most amplifiers are equipped, although a valuable accessory, can be wrongly used and sometimes is, particularly in emergencies. It's correct use is described below.

IT IS sometimes forgotten that while amplifier meters (unless defective) always tell the truth, they never tell the whole truth. Hence in emergencies a low meter reading is sometimes misinterpreted as the whole cause of the difficulty, and valuable time with an audience waiting is wasted while a new tube is inserted and warmed up, the real trouble being elsewhere.

Proper use of the amplifier meter is facilitated by a clear understanding of just what this instrument does and what it does not do. In connection with an amplifier tube, for example the meter does *not* tell how well the tube is amplifying. Measurement of amplifying power is a somewhat complex business, not within the scope of any simple meter or any simple tube tester.

Amplifier meters in theatre equipment are of two general types, both of which work in the same way, electrically speaking. Equipment of earlier models is often fitted with meters that give a direct current reading of so-and-so many milliamperes. Sometimes there is a red line on the dial to show what the correct reading for a given tube should be, sometimes not. The projectionist using these meters is expected to know when the reading is so far from normal that the tube should be changed. More modern systems generally have meters showing no scale of figures, but only colored areas. Thus the projectionist need not trouble himself to remember the toleranecs of a given tube. If the needle comes to rest within the "good" area the tube has passed its test, otherwise it is replaced. Where the same meter tests several tubes the wiring is so arranged that all of them, if normal, will read "good" in spite of the fact that their several space currents may not be at all the same.

Whichever type the meter may be, it is simply an ammeter, connected in series with the current flowing across the vacuum of the tube, and it reads that current. This is all it does. The same is true of the meter in any ordinary, low-priced tube tester.

Amplification, of course, is a matter of the ability of the tube to introduce variations into that space current, causing it to increase and decrease in strength. Since these variations, in the case of sound equipment, occur at frequencies of from 50 to 9,000 cycles per second, the meter normally ignores them. The needle cannot respond to such quick changes, but gives an average or overall reading.

Now this over-all reading may be normal, low or high. In some cases the needle may fluctuate, but not at any such frequency of 50-9,000 cycles. Finally, there may be no reading at all.

Watch Your Tubes

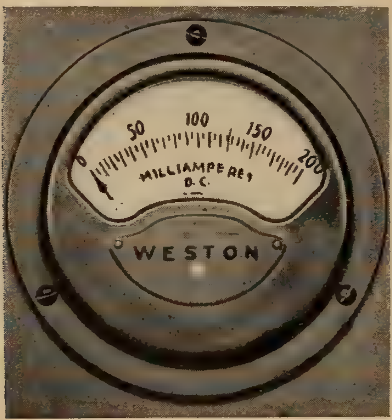
No reading: If there is no reading, very likely there will be no sound, although some amplifiers are so wired that they will continue to function at reduced volume even if one tube fails entirely. None the less, a tube that shows no reading should be replaced instantly, even if it is necessary to stop the show. A more serious burn-out may follow, requiring extensive and lengthy repairs, if this condition is neglected.

Low reading: Presents a more complex situation. A tube with a reading below the established tolerance should be replaced at the first opportunity, but this is a function of routine maintenance, and not necessarily one associated with emergencies. The fact that the meter shows the tube to have a low space current does not mean with any cer-

tainty that that tube is impairing the sound. It may be. And it may be doing no other harm than to reduce the volume a little. It should be replaced, but the meter reading does not always mean that any and every trouble under investigation has been found.

Complete sound outage, for example, is not likely to be the result of low space current in one tube,—unless the reading is extremely low, and not invariably even then. A moderately low reading is not necessarily associated with noisy sound, or even, in every case, with distortion. It is likely to be related, however, to low volume.

In short, sound troubles should be run down systematically according to a pre-arranged plan. It is a mistake—and one likely to add to audience impatience in time of trouble—to assume that the amplifier meter answers all problems.



Above is the old type amplifier meter using a numbered dial.

Normal reading: It may seem strange to some, but the fact that the meter shows a tube to be good does not always mean it is. The meter, remember, reads only space current. Generally speaking, if a tube has normal space current, it will operate normally. But this does not always follow. It may have normal space current and be noisy. It may also (though this is rare) show normal space current and fail to amplify normally. A "good" meter reading can be taken as acceptable evidence that the tube is alright, subject however to further investigation and experimental replacement of the tube in stubborn trouble cases.

Danger Sign

High reading: In an old tube is a sign of danger, and the tube should be replaced at the first convenient opportunity. New tubes, on the other hand, sometimes read slightly high when the manufacturers have built a little extra life into them. High reading in an old tube, however—that is, in a tube that has formerly read lower, needs prompt attention. It may mean some fault in the amplifier that has lowered grid bias. It may mean excessive plate voltage, possibly due to high line voltage. Either condition is dangerous, since it means excess current is flowing which very possibly will overheat some part of the circuit, resulting in deterioration of some parts, or even in something burning out. High reading may mean a "gassy" tube. This is always true if the tube also shows a blue glow that it never exhibited before. If the blue glow was always present in that tube it may mean nothing, but if it appears after some period of use, and is associated with a higher meter reading, it means the vacuum has deteriorated and gas is present. A gassy tube always distorts the sound more or less—further, the condition may grow progressively worse, with corresponding increase in space current that is dangerous to other parts of the amplifier. Replace the tube as promptly as convenient.

Fluctuating reading: The significance of this condition depends on the type of amplifier used. In a Class AB or Class B amplifier, working at high volume, it is normal, but most theatre amplifiers that have meters are Class A, and a fluctuating reading means overloading and distorted sound. This may mean that the volume has been run up higher than the system can stand. If a fluctuating reading appears at volume settings which never showed that condition before, look for a tube with a low meter reading and replace it. If the trouble persists, there is a serious fault in the amplifier to be run down and corrected,—except where the line voltage is fluctuating badly, which should be reported to the power company for correction.

The new style meter, above, uses colors instead of numbers, making for quick reading.

All of the foregoing refers to conditions under which the meter measures one tube at a time. This is not always the case. Some meters are connected to read current to two or even four tubes simultaneously. Then the interpretation of their action becomes a little more complex. A low reading becomes more important, because it may mean that only one tube is reading low, while the other is balancing the condition by carrying an excessive load. The excessive current through the good tube may overheat or damage something. Replace all tubes concerned till the faulty one is found.

A normal reading does not in this case mean that all the tubes are behaving normally. Again, one may be counterbalancing some defect in another. In routine maintenance, use a new tube to replace the working tubes one at a time. Any startling change in reading when this is done will indicate that the tube just replaced was faulty. It need not always be discarded; it can be kept and later matched with another that has the same meter reading, unless it is gassy. A gassy amplifier tube should never be used.

A high reading, when the meter reads more than one tube at a time, may mean that one is gassy, or that all tubes are carrying more than normal current because of some undersirable condition, usually high line voltage, which should be corrected even at some cost to the theatre. A fluctuating reading is treated in the same way as fluctuating reading in a single tube.

Sometimes there are two tubes in one envelope—double tubes, so to speak. This is common in the case of rectifying tubes, and some amplifying tubes are built that way. One of the twin structures may develop a fault while the other remains normal. Unless the amplifier meter is connected to test each half of a twin tube separately, the projectionist should follow a liberal policy with respect to replacement whenever meter readings depart even moderately from normal, since such departure may indicate that one of the twins is in seriously poor condition, and the other half of the tube is compensating for this by carrying a dangerously high load.

Y & W FOR ALTEC

Y & W Management Corporation, of Indianapolis, Indiana, has appointed the Altec Service Corporation to take charge of service in the 12 Y & W Theatres in Indianapolis and vicinity. F. C. Dickely negotiated for Altec.

IA BUYS BONDS

Detroit.—IATSE Local B-25, covering film exchange employes, has voted to appropriate $2,000 from the union treasury for the purchase of Defense Bonds, according to Bert Holmes, business agent.

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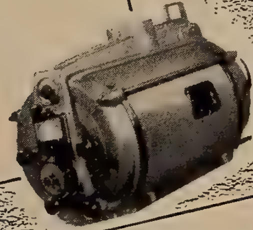

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THERE'S A BRANCH NEAR YOU

Progress In Three-Dimensional Films

J. A. NORLING

FROM A REPORT TO S.M.P.E.

Recent years have seen improvements in still and movie stereoscopy that have given impetus to their commercial exploitation. The developments that have resulted in their commercial acceptance have been in the nature of refinements rather than in radically new devices. Experimental work on many such new devices has received notice in the public press and in technical journals.

SOME of the problems encountered in the production of three-dimensional motion pictures and the methods suggested for exhibiting them have been reviewed in a previous article. This present paper is in reality a supplement to the earlier one, and, in addition, will deal with some of the problems of projected three-dimensional still pictures.

The first commercial application of Polaroid to three-dimensional pictures was in 1939, when a 35-mm black-and-white three-dimensional production was used as a featured attraction at the Chrysler Corporation's exhibit at the New York World's Fair.

During the year 1940, two other 35-mm three-dimensional films were made and exhibited. One was a new film entitled *New Dimensions*, for Chrysler's 1940 New York World's Fair Exhibit and was produced in Technicolor; the other was a 35-mm black-and-white film called *Thrills for You*, which was the major attraction in the Pennsylvania Railroad's exhibit at the Golden Gate International Exposition in San Francisco.

About four million persons have viewed these three films, so it is probably safe to say that real three-dimensional motion pictures have emerged from the experimental and novelty stage.

The success of three-dimensional motion pictures both with Polaroid as a projecting and viewing means as well as the earlier anaglyphs using red-and-green spectacles, has stimulated great interest in further exploration of the possibilities of projected stereoscopic pictures. Still stereograms as well as cine stereograms have received attention, and a few recent improvements have been made, particularly in projectors. Most of the projection devices presented have employed polarized light. The "eclipse" system has been experimented with for motion pictures, and a still picture projector utilizing this method was put on the market recently. This method requires a shutter on the still projector, synchronized with shutters on individual viewing devices. Another method uses prism viewing spectacles fitted with a baffle for each eye to block the unwanted images.

All these methods and devices have interesting possibilities, but at present the polarized-light system is the only one that provides simplicity and economy *together with a satisfactory quality in the projected picture.*

Camera Equipment

To photograph three-dimensional pictures requires cameras having twin lenses or some other provision for obtaining pictures from spaced viewpoints. When two lenses are used, it is recognized that they must be very closely matched. For practical reasons there must be some tolerance in matching. Lenses that match each other within one-half of one per cent in focal length will be satisfactory. It is advisable to keep the two images to the same size within a tolerance of not more than one-half per cent.

Definition is more important in stereoscopic picture making than in ordinary photography. Three-dimensional images should be crisp, clear, and as sharp as possible throughout the whole scene depth. Lenses should be highly corrected and capable of being operated at small apertures. Surface-treated lenses are particularly advantageous since they are capable of producing images of superior quality.

Matched lenses in sets of various focal lengths are required to extend the operating range of the camera. However, it is questionable whether extreme long-focus lenses are ever going to be widely used, if at all. In my judgment, the useful range of focal lengths is from the shortest (widest angle) that can be used up to a focal length of about four times the diagonal of the picture.

The mounting of the lenses is important. The ordinary stereoscopic camera has its lenses mounted so that the axes are parallel and extend perpendicularly from the center of the picture plane. This is acceptable and good practice for most subjects but it may be desirable to change the axes so that the image centers will converge at some point in the scene. It is therefore advantageous to have the lenses mounted so they can be rotated or shifted or both.

Most stereoscopic cameras have the lenses mounted at a fixed interocular distance. In many cases it is desirable to use less than the normal 2½-inch spacing, and in some cases it is desirable to extend the spacing to many times the normal. A versatile stereo camera will, therefore, have provision for changing the lens interocular.

There are on the market many types of stereoscopic still cameras. They range in size from those using 35-mm film up to such cameras as the "StereoGraphic" which makes the pair of pictures on one 5 × 7-inch plate. There are also several attachments employing prisms or mirrors. These are made to fit on a single-lens camera and produce two images on the plate or film within the space occupied by the single image when using the lens without the attachment.

These cameras and attachments are adequate for making stereograms that are to be looked at through a lens or prism-type stereoscopic viewer, but are lacking in versatility for the production of stereograms to be projected on a screen.

To obtain results beyond the capacity of the standard stereo still camera it is necessary, at present, to have the desired features built into existing models.

In order to obtain pictures with proper "borders" the operator has to be able to shift the lenses in relation to the centers of the plates (or to shift the plates in relation to the optical axes). To obtain the best three-dimensional effect he has to be able to select a narrow interocular for close-up work and a wide interocular for distant scenes. In the ordinary stereoscopic camera with parallel lens axes the "border" is at infinity. Under these conditions there is no actual stereoscopic "border," or stereoscopic "window" at all. It is generally conceded that the most pleasing projected stereogram results when the spectator sees it as if looking through a window—when the scene seems to exist behind the window or screen frame.

For still-life subjects a single camera may be used, the exposures being made successively. The camera is mounted on a slide-board and the interocular may be any selected value from zero to as great

as the capacity of the slide-board. For action shots or exposures of short duration the two pictures must be made simultaneously.

Apparatus for action shots may be made up of two cameras mounted on a common base and so arranged that the interocular may be varied by moving one or both cameras. The shutters must be accurately synchronized and the timing of the shutters closely matched.

The requirements for making still stereograms apply also to motion picture stereoscopy. For instance, in scientific films it may be necessary to photograph a very small object, such as an insect, quite close to the camera. This demands a very narrow interocular. On the other hand, some scenic shots are vastly improved by spreading the lenses apart, thus obtaining a greater three-dimensional effect.

Limited Range

Obviously it is difficult, if not impossible, to build one camera with such a wide range. Several cameras may be required to cover a wide variety of subjects.

Since photoplay production does not demand the photography of minute objects, it seems reasonable to assume that only a limited interocular range will be needed. A range of interocular from 1½ inches for close-ups up to 4 inches for long shots should be adequate for the average photoplay. It is possible to provide this range in one camera.

The same desirable features regarding convergence of the picture centers in making stereo movies, because "bordering," that is, establishing the proper margins at right and left, must be done, and can be done, only in the camera.

The finder on a stereoscopic motion picture camera is an important accessory, and its functions differ in some important respects from standard practice. It is desirable to view the scene in three dimensions and to see both images so that proper alignment for convergence and bordering can readily be effected. Naturally the finder images must be right side up and not reversed left for right. A binocular finder of the right kind enables the cameraman and director to determine by visual means the lens interocular considered best for any given scene. Of course, general rules must be established for interocular spacing depending upon distance of principal object and magnification of the lenses employed, but occasionally it may be desirable to increase the depth of a scene to enhance its dramatic effectiveness.

No data are included in the present paper on interocular spacing *versus* distances and magnifications because there is little agreement among research men and operators as to recommendations.

Everybody agrees that "excessive" interocular spacing creates distortion. The controversial point is to define the words "excessive" and "distortion" as applied to the problem. Broadly, the whole matter of interocular spacing and magnification in the taking of the scene should be influenced by the conditions of projection under which the picture will be shown. Therefore, it is of great value to know beforehand what will be the average conditions of screen angles, seating arrangement, *etc.*

John T. Rule, of Massachusetts Institute of Technology, has contributed valuable data on the geometry of stereoscopic projection in a recent paper.

Projection

The projection of the Polaroid three-dimensional 35-mm motion pictures that have been mentioned has been done through two synchronized projectors. In one case synchronism was obtained by electrical interlock; in the other, by mechanical means. Both systems worked excellently. Since projection of the pictures was on a "grind" basis, with very short periods between shows, and there were no breakdowns, it is evident that either method is satisfactory.

Considerable experimental work has been done with 16-mm projection but no actual use has been made of 16-mm stereograms for commercial purposes. The indications are that such equipment will be available sometime this year.

Several types of stereoscopic still projectors have been introduced, and the three-dimensional projected still picture is coming into wide use for display and advertising purposes.

Types of Projectors

At present there are on the market two types of projectors using Polaroid and one using the "eclipse" system. One of those using the Polaroid method projects stereograms consisting of pairs of standard 3 × 4-inch lantern-slides; the other is equipped for both 2 × 2-inch slides and 35-mm slide-films.

All these projectors employ dual optical systems. One type uses two lamps, and the projector for slide-films uses a special lamp containing two filaments.

These new projection facilities should be of interest to the scientist as well as the advertiser. The medical profession can utilize them for many purposes. Gross specimens, operations, and radiographs may be enlarged in three-dimensional form and may be viewed by large groups. Engineers can obtain photoelastic records obtained by polarized light in three-dimensional form to facilitate the study of stresses and strains in the various planes of the plastic model. Any number of other interesting possibilities present themselves.

PROJECTIONIST INVENTOR

Toledo, O.—Lawrence Aubry, local operator, has invented an auto burglar alarm guaranteed to scare the pants off car thieves. He conceived the idea while repairing a short circuit in a projector.

The device gives off a toot of the horn at the slightest nudge and a rip-snorting toot as the nudge is increased.

Aubry has applied for a patent on his invention.

GOVERNMENT WILL BUY USED 16MM PROJECTORS

Washington.—Owners of 1939, 1940, and 1941 model sound projectors for the showing of 16 millimeter motion pictures were asked last week by the War Production Board to offer them for sale to the Government.

These machines are essential for the rapid teaching of the Armed Forces and defense workers. Due to the present aluminum shortage, production of new projectors, which requires the use of aluminum casting, is being curtailed.

Approximately 35,000 16mm. sound projectors were manufactured in 1939, 1940, and 1941, and sold for various purposes. Many of the purchasers were large corporations, such as automobile companies, which used the machines for sales promotion.

Any private individual, business organization or school owning such machines is requested to write to the WPB, stating the number of machines he owns, how many he is using for defense training, and how many he is willing to sell, the year model or models, and what price he is asking for them. The WPB will not itself buy the machines but will transmit the information to the War and Navy or other Government departments who can then buy the machines they need.

MOVIE ATTENDANCE UP

Theatre attendance this year, under the spur of continued expansion in employment and payrolls, will show a gain exceeding that of last year when an advance of 10 per cent was scored, according to the current survey of the film industry by the authoritative Standard & Poor's. The survey says in part:

"Movies should benefit particularly from the war. The public, with the largest income in years, now finds many of its customary diversions either drastically reduced or virtually eliminated by the war.

PROJECTIONIST BURNED

Winchester, Ky. — Ernest Kimbrell, projectionist at the Town Hall, was burned about the head and arms when a roll of film broke and caught fire in the booth. He spent one night at a local hospital after being treated.

In the theatre at the time of the fire were about 200 patrons. They were directed safely to the exits by Manager Dallas Hall and Charles Burton, ticket taker.

17,919 THEATRES IN U. S.

According to a recent survey there are now 17,919 picture theatres in operation in this country—an increase of 378 over 1940. The average seating capacity is 517, with houses located in 10,013 towns and cities.

Conservation Is Keynote of Top Men

Sound Warning That Priorities Will Put Projectionists on Their Own Initiative to Keep Their Machines in Continuous Operation

THE work done for projection preparedness during the past year and a half, which was to a considerable extent the result of confidential conferences with a group of well-known leaders in the motion picture technical field and city officials, was explained at a luncheon given in New York by P. A. McGuire, Advertising Manager of International Projector Corporation.

Among those present were James Lynett, Supervising Inspector, City of New York, Department of Water Supply, Gas and Electricity; Bart Greene, Chief Inspector, Borough of Manhattan; Lester B. Isaac, Director of Sound and Visual Projection, Loews Theatres, and Harry Rubin, Paramount; Frank Cahill, Warner Brothers, and Chas. Horstman, RKO, occupying similar positions with these major circuits. Also M. D. O'Brien, Assistant Director, Loews and Chas. J. Bachman, Sound Engineer, Warners Theatres.

Lynett spoke of the danger and destruction caused by defective equipment and carelessness or neglect of any nature in the projection room. Isaac told of the work his company had done for projection preparedness by installing new equipment in most of the Loews Theatres in the past year and a reference was made to a midnite meeting held in Loews Ziegfeld Theatre in which nearly 600 of the Loews staff were present, including high officials of Loews, district managers, managers, assistant managers and projectionists. At this meeting the new equipment which was being installed was explained in talks given by representatives of the manufacturers.

Harry Rubin, for many years Chairman of the Projection Practice Committee, S.M.P.E., spoke of the work done by them which has been an important contribution to technical advancement in the motion picture industry.

Chas. Horstman, new Chairman of the Sub-Committee on Projection Practice of the Theatre Engineering Committee, expressed a strong desire to have his committee cooperate in every possible way to improve projection and increase projection efficiency in all theatres.

Frank Cahill stated that he believed that all those present at the luncheon, in their various positions, were actively cooperating with the War Activities Committee and were 100% with P. A. McGuire in the work he was doing to interest projectionists in the National Conservation Plans.

O'Brien and Bachman made suggestions for meeting emergencies created by existing conditions and these will be taken up and informally discussed by members of the group.

McGuire spoke of the series of technical lectures given to I.A. Locals by representatives of IPC in many cities during the past two years, sponsored by the NTS. These talks were of a technical nature and were well attended and received by projectionists. He laid particular stress upon the splendid support by I.A. officials, presidents and business agents of I.A. Locals are giving to the plan to have all I.A. Locals form Educational Committees to cooperate with the National Conservation Campaign.

Men who have always been active and progressive projectionists, such as Thad Barrows, President of Boston Local; Tom Reed, Business Agent, Washington, D. C. Local; Frank Sutton, Norfolk, Virginia; William Nagengast, I.A. Local No. 640; Lawrence Katz, Secretary District No. 4, Harrisburg, Pennsylvania; O. M. Jacobson, District No. 1, Tacoma Washington, and Raywood, Business Agent of Miami Local, have heartily endorsed the idea and it is believed that eventually every I.A. Local will have an Educational Committee.

It was pointed out that some kind of a group was necessary to give these ideas form and substance but the important positions held by these men made it difficult to give outright endorsement to any organization. The following written statement which was read at the luncheon was fully approved and will be given support.

All I.A. Locals should appoint active Educational Committees for the discussion of technical subjects and thereby cooperate with the Government's National Conservation Plans. Many Locals have such committees. If every projectionist can be made to realize the difficulty of getting part replacements and service, initiative will be developed which will enable them to anticipate and prevent emergencies. Continued discussion of the many technical problems that come to projectionists, regular reading of technical books and technical items and articles in the trade publications, will result in an exchange of ideas and enable all projectionists to refresh their

The men above are in session at Sardi's for a luncheon and discussion of a plan for Educational Committees in each Local for the exchange of ideas for the conservation of equipment. They are, left to right, Charles Horstman, P. A. MacGuire, James Lynett, Lester B. Isaac, Harry Rubin, Frank Cahill, Charles J. Bachman, Bert Green and M. D. O'Brien.

Non-Synch Phonograph Valuable Trouble-Shooting Device

The non-synch phonograph, which most projection rooms have in one form or another, can be used as a valuable trouble shooting device. Its full possibilities in that direction are not always realized. Also it has entertainment possibilities beyond those of curtain music and exit march.

THE non-synch can be very helpful in trouble-shooting, particularly in procedures of elimination, which is, of course, the commonest kind of trouble-shooting. Playing the non-synch eliminates both of the soundheads, their amplifiers and switching arrangements, and exciter lamp and photocell supply circuits. In short, a very large part of the entire sound system can be removed from need of further investigation by switching to non synch for a moment. If the trouble remains, it must be associated wtih the power amplifiers or the speaker circuits; if it disappears power amplifiers and speakers are eliminated from further search.

There is no other single step of elimination in the average sound system that covers as much ground so quickly.

Use of the non-synch in this way is particularly valuable in cases of sound outage, low volume, hum and extraneous pickup of any kind. It is of course needless in such conditions as flutter, the source of which is obvious, and in cases where the trouble appears when one soundhead is used, but not with the other.

The non-synch is also useful in connection with some sound transmission tests, carried out with test film and a decibel meter. To utilize the non-synch in connection with such tests, the projection room must obtain a frequency test record, which is not expensive. When everything is working perfectly take a run with test film and another with the test record, and keep the notes of the results where they will be readily available—perhaps with spare parts. Repeat the process when looking for forms of trouble that are found by such tests. Comparison will show whether the trouble sought is in the system amplifier, or is associated with the soundheads. The preliminary test made when everything is working well may be eliminated if both test record and test film are obtained from the same supplier, and are calibrated correctly with respect to each other.

Reverse Needle

The non-synch is also useful in adjusting and pointing speaker baffles when test films used in this work are not available. It is necessary to prepare a record. Take the oldest, cheapest, most useless record that can be found or bought, and prepare it by running it over and over with the phono needle *reversed.* This will destroy the sound recorded in the groove, and when the needle is turned around and the record played properly, only a high-frequency, rasping sound will be heard. This can be used to check the distribution of high frequencies throughout the auditorium. The record may have to be run with reversed needle dozens or hundreds of times, depending on its material, before it is brought to the right condition, but of course no one listens to it—just puts the needle back every few minutes to repeat the process. The sound output from the reproducer is not switched to the amplifier.

Above is the non-synch phonograph which can be put to many uses as described in this article.

And the non-synch is useful in any tests or trouble-shooting relating to the system amplifier that require a source of sound, as, for example, headphone tests of sound circuits. While any film threaded in the sound head will serve the same purpose, the non-synch is often more convenient. Particularly, a multi-frequency test record is more convenient to use than a multi-frequency test film, because the needle can be moved from one frequency to another in a moment, while film is not manipulated quite as readily.

The non-synch of course has its own troubles, but they are few and simple, since the device is simple. Flutter, owing to inadequate motor lubrication or other motor fault, or to a motor too small to do good work, becomes important of course when the non-synch is used for test purposes, while moderately severe flutter impairs sound qauilty even in curtain music.

Motor speed is usually adjusted with a stroboscope, obtainable at a few cents from the supplier of the equipment or from a large radio store (except in d.c. regions, where the stroboscope won't work and revolutions must be counted). Projectionists also must remember to keep the non-synch absolutely level in every direction. Mount it permanently, on a shelf installed for the purpose if necessary. Just as the non-synch is not always used to its full advantage in trouble-shooting, so its entertainment and exploitation values are not as completely utilized everywhere as they might be.

Inexpensive Equipment

One theatre at least makes its own records for use on the non-synch. This is not very expensive. The blank discs cost no more than an average phonograph record. The recording apparatus would be somewhat costly, running to some hundreds of dollars, if it were desired to record a symphony orchestra or turn out any other first quality recording. But for the kind of light entertainment, exploitation and local references used by the theatre in question, the more inexpensive kind of recording equipment is entirely adequate, the cost of the machine being considerably under one hundred dollars.

These are of course unusual uses of non-synch equipment, where local regulations allow, is the playing of curtain

(*Continued on page* 20)

(*Continued from preceding page*)

memories regarding the highly important work of their craft.

The value of the Educational Committee lies not merely in formal discussion and regular meetings. In effect, wherever and whenever two projectionists discuss technical subjects connected with their work, it can be said the Educational Committee is in session.

Projection is the final delivery to the public of all the work of this industry. Upon it largely depends the pleasure of millions of patrons of motion picture theatres. The pioneer projectionist was a highly important factor in the development of the motion picture industry. The competent, progressive projectionist of today has a magnificent opportunity to contribute to the maintenance of public morale and to cooperate with the National Conservation Plan. "The show must go on" is a tradition of the theatre.

The group will continue to hold occasional meetings and by discussion and conferences will endeavor to encourage all worth while ideas which will promote projection preparedness and progress. Developed on a national basis through the trade publications, it is believed this will be a great aid in preventing waste and cooperate in the National Conservation Campaign.

Inefficient Exchange Procedure To Blame For Most Mutilated Film

MUCH has been said and written as to what constitutes efficient exchange procedure, and as to whom can be blamed for the mutilation of projection prints. Many in both projection and exchange circles, feel that there has been too much "passing the buck."

The people who work on "film alley" comprise a hard-working, conscientious group who put all they have into their job. What they do is usually well done; but lack of information and instruction cannot be blamed on them. It is safe to say that not five out of a hundred inspectresses, shippers, or any other persons directly connected with the care of film in the exchanges, have ever been inside a projection room, or even have any idea just how the film is used in the theatre. The exchange heads are to blame for this disgraceful situation. Few instructors are ever supplied to teach methods new or old. The policy has been to let a new girl "just sort of learn" from the head inspectress or any one who has time to teach her, in the rushing, pulsing business of getting the film out to the theatres.

Total Lack of Instruction

There is never any instruction as to the proper way to paint the sound track after making a patch. They know the sound comes from the sound track, but they don't have the faintest idea how, and a bad painting job looks just as good as any other. Of course, we know that a bad one is worse than none at all. Alignment of patches means nothing to them as long as the patch holds together. Why should it? They have never seen the various and sundry gadgets men have been putting on machines for years to keep film running smoothly over fast moving parts. While some few know that over-scraped patches mar the effect of projection, others say let it go as long as it holds together. They are pushed so hard on shipments that often they don't have time to make necessary replacements.

In the majority of exchanges the film, if of any box-office value at all, is booked so close that often there is only time to get the print off the incoming truck, put a shipping label on it, and put it on the outgoing truck. One of the biggest sources of film mutilation is caused by the film being poorly rewound on the reels in such a manner that some of the edges are left sticking up. In this case the weight of the other reels in the container causes these edges to be crushed and broken. The distributors blame projectionists for this mutilation. Distributors contend that if they send the film out on new reels, projectionists will steal them and send back old ones. That may be so; but it is uncommon to see an exchange reel, new or used, that any self-respecting projectionist would keep.

Many inspectresses think it a good thing to coat a print with heavy vaseline. You can imagine the grief of the poor fellow who ran such prints. It is a not uncommon thing to see an inspectress hold the end of the film tight and "pull the reel up" after rewinding loosely. Between the dust collection and the friction it doesn't take much of this, no matter how well a print is processed, to make the projected image simulate a cloudburst.

Up-to-date Information

Organized projectionists are fortunate in being able to acquire up-to-date information on what is going on in their phase of the industry. This statement is substantiated by the many improvements and inventions that have come from the craft itself. Plainly speaking, "they know what it is all about." There is no attempt on the part of the craft to tell the distributors how to run an advertising campaign; but the lack of knowledge about the film itself in exchanges is pathetic and merits sharp criticism. Now that the exchange workers are being organized, the union projectionists should take a hand in showing them what is expected of film classified as a good print. There is no need to teach them how to project, but only to teach them how to inspect from the projectionist's standpoint, which after all is the logical one.

IA BOMBER

The IATSE has placed before its membership a proposal that a fund be established to buy a bomber for the Army. The money would be raised by voluntary contributions ranging from $1 to $5 from each member of every local in the land.

Defense bonds totaling nearly $600,000 have been purchased by its locals throughout the land, the IATSE reports.

PITTSFIELD BLAZE

The Capitol theatre, Pittsfield, Mass., has suffered its third fire in two years. The last blaze did $75,000 damage. The house is owned by the Western Massachusetts Theatres, Inc.

QUICK FUSE-CHANGING WITH NEW LITTLEFIELD UNIT

An entirely new convenience for changing fuses in close quarters—replacing a blown fuse in a twinkling and giving notice on inspection that another spare is required—are features compactly embodied in a spare fuse holder and puller combined, just announced by Littelfuse, Inc., Chicago.

The fuse in circuit goes through one end of the soft rubber rectangular holder, between the clips. Above, and at right angle, is an opening in the holder for the spare fuse. When inserted, the caps of the spare fuse project beyond the holder affording an easy grip for two fingers. When the fuse in circuit blows, all one has to do is to pull and reverse the holder. This puts the spare fuse in circuit and brings the blown fuse on top in the same position that the spare was in before. The change is easily made in a moment.

Easy Replacement, Definite Warning

One end of the holder and puller is painted red. Until a fuse change is necessary, the red end is underneath, out of sight. When a reverse is made, putting the spare fuse in circuit, the red end is brought into full view on top. To an inspector or service man this red signal instantly indicates that a fuse has blown and that another spare is required. If the end is black, both the fuse in circuit and the spare are still serviceable. Fuses are easily removed and replaced. "Windows" in the device keep the elements of both fuses in view at all times.

CANADIAN LABOR LAW HITS THEATRE PROJECTIONIST

Toronto.—Latest obstacle for film business in Canada is the action of the Federal Government placing film distributing companies and theatres in restricted occupation categories, thus preventing hiring of new male employes for any purpose, between 17 and 45 years of age unless the applicant was previously discharged from the armed forces or is medically unfit.

The film trade is one of the stated businesses affected by the new conscription order under which theatre or film exchange employes are made liable for the army or for transfer to war industry without replacement by male employes of military age.

The order provides that positions are to be held open for drafted men after the war.

RCA EXECUTIVE CHANGES

George K. Throckmorton, for the past five years president of RCA Mfg. Company, Inc., has been elected chairman of the executive committee of that company. Robert Shannon, former executive vice-president, has been elected president.

AROUND THE CLOCK

Washington.—The Trans-Lux theatre here is planning to operate its local newsreel house on a 24 hour-a-day basis.

2 A. M. CURFEW

San Francisco.—Following an experiment of remaining open until 5 a.m., to accommodate defense workers, the Esquire theatre has been forced to close at 2 a.m., due to defense ruling which calls for a two o'clock curfew on theatres and night clubs.

Fibre Containers Will Soon Supplant Metal Film Cans

A HEADACHE is in store for projectionists with the prospect of fibre containers for film. This will mean damaged film through careless handling of the fragile containers. As yet the government has not clamped down completely on the metal containers, but an order has been sent out to film manufacturers, laboratories and studios to prepare for the fibre containers.

The new "cans" priced at seven cents each, will cost the film manufacturers approximately $105,000 for the initial batch. There are now about 1,500,000 tin cans for film carrying. The swingover from tin to cardboard will be a gradual process and it is hoped that shippers in exchanges will learn to handle the new containers with care.

If the cans now in use are used exclusively for shipments between exchanges and theatres it is possible that they may last for several years, with extra special care. It will all depend on how much abuse they get. It will certainly be to the advantage of projectionists to keep the metal containers in condition as long as possible for the men in the booth have enough to contend with without taking on the additional burden of battered and torn cardboard.

SMPE CONVENTION WILL DRAW TOP INDUSTRY SPEAKERS

The stage is set for the 51st Semi-Annual convention of the Society of Motion Picture Engineers, with a heavy schedule in the offing. The meeting will be held in Hollywood and although the program is not yet complete, it is reported that top men of the industry will speak before the convention.

The committees are:

Pacific Coast Papers Committee—R. R. Scoville, chairman; G. A. Chambers, C. R. Daily, F. L. Eich, W. W. Lindsay jr., S. P. Solow and W. V. Wolfe.

Reception and Local Arrangements—C. W. Handley, chairman; J. O. Aalberg, B. B. Brown, G. A. Chambers, W. E. Garity, A. M. Gundelfinger, E. H. Hansen, J. K. Hilliard, E. M. Honan, B. Kreuzer, R. G. Linderman, C. L. Lootens, R. H. McCullough, W. C. Miller, G. S. Mitchell, K. F. Morgan, H. Moyse, W. A. Mueller, G. F. Rackett, H. W. Remershied, Alston Rodgers, L. L. Ryder, S. P. Solow, H. G. Tasker and J. R. Wilkinson.

Registration and Information—W. C. Kunzmann, chairman; F. Albin, L. W. Chase, J. Frank jr., J. G. Frayne, C. W. Handley, Sylvan Harris and F. L. Hopper.

Publicity—Julius Haber, chairman; G. R. Giroux, west coast chairman; L. A. Aicholtz, J. W. Boyle, J. L. Courcier, Sylvan Harris, S. E. Hawkins, G. S. Mitchell, E. C. Richardson and R. R. Scoville.

Luncheon and Banquet—L. L. Ryder, chairman; J. O. Aalberg, J. G. Frayne, C. W. Handley, E. M. Honan, Emery Huse, H. T. Kalmus, M. S. Leshing, N. Levinson, R. H. McCullough, W. C. Miller, Peter Mole and H. G. Tasker.

Hotel and Transportation—G. A. Chambers, chairman; A. C. Blaney, D. J. Bloomberg, L. F. Brown, J. P. Corcoran, C. R. Daily, Carroll Dunning, W. C. Harcus, G. T. Lorance, H. R. Lubcke, F. O'Grady, J. W. Stafford and W. L. Thayer.

Convention Projection — C. L. Russell, chairman; J. O. Aalberg, J. Durst, G. M. Farly, B. Freericks, W. E. Gebhart jr., L. D. Grignon, J. K. Hilliard, A. E. Jackson, W. W. Lindsay jr., R. H. McCullough, S. M. Pariseau, H. W. Remershied, C. R. Sawyer, G. E. Sawyer, H. A. Starke and officers and members of Los Angeles projectionists, Local No. 150.

Ladies' Reception Committee—Mrs. Emery Huse and Mrs. J. G. Frayne, hostesses, assisted by Mrs. G. A. Chambers, Mrs. F. L. Eich, Mrs. A. M. Gundelfinger, Mrs. C. W. Handley, Mrs. J. K. Hilliard, Mrs. E. M. Honan, Mrs. B. Kreuzer, Mrs. N. Levinson, Mrs. R. H. McCullough, Mrs. G. S. Mitchell, Mrs. Peter Mole, Mrs. K. F. Morgan, Mrs. W. A. Mueller, Mrs. G. F. Rackett, Mrs. H. W. Remershied, Mrs. E. C. Richardson, Mrs. L. L. Ryder, Mrs. R. R. Scoville, Mrs. S. P. Solow, Mrs. J. R. Wilkinson and Mrs. W. V. Wolfe.

Color Print Exhibit Committee—O. O. Ceccarini, chairman; L. E. Clark. T. B. Cunningham, Carroll Dunning, R. M. Evans, L. D. Grignon and A. M. Gundelfinger.

TIRES AND PROJECTIONISTS

Detroit. — Numerous switches are being made by projectionists here due to the tire shortage. The men are rearranging work in theatres close to their homes.

Theatre owners are cooperating with the projectionists in an effort to locate men within walking distance of their homes, or near lines of transportation.

OPERATORS' DISPUTE IN ATLANTA IS SETTLED

Atlanta—Differences between the local theatre owners and projectionists have been settled by joint arbitration.

Operators in community houses will get $1.09 per hour under the contract that runs until the latter part of April, when a new one will be negotiated.

The dispute arose when operators served notice on theatre owners that their old contracts were voided by a clause which abrogated the contract in case of war.

Albert Gossett and William Kemp represented the operators at the arbitration negotiations.

GENERAL THEATRES EARNINGS

The General Theatres Equipment Corp., in its annual report for 1941 shows net earnings of $1,315,418 or the equivalent of $2.24 per share, compared with $1.45 per share in 1940.

NO BLANKET DEFERMENT FOR PROJECTIONISTS

Reports that sufficient maintenance men, including projectionists, would definitely be deferred to keep the country's theatre equipment in operation were laid at rest over the week-end by Selective Service headquarters here.

Draft officials said that there would be "no blanket deferment" in favor of any trade or profession or any special group of workers under any circumstance, at least not as the Selective Service law stood at present.

"There could be no blanket deferment of any group unless Congress were to pass an amendment to the Selective Service Act to grant such a special privilege," said one draft official.

It was emphasized that in no circumstance would an exception be made from the practice of judging each application for deferment on its individual merits. "It's all up to the local board," the same official asserted.

He added that a theatre maintenance man could be exempted by his local board only if in its opinion he was held absolutely indispensable to the job he was holding.

RCA's 10 MILLION NET PROFIT

RCA and subsidiaries for the year ended Dec. 31 earned a net of $10,192,716, an increase of $1,079,560 or 12 per cent over 1940. Net is equal to 50.2 cents a share on the common after payment of all preferred dividends. In 1940, the common earned 45.2 cents.

Total gross income from all sources amounted to $158,695,722 in 1941, compared with $121,439,507 in 1940, an increase of $37,256,215.

Operations for 1941 compared with 1940 show an increase in gross income of 31 per cent, an increase in net profit of 12 per cent, and the increase in the number of persons employed of 20 per cent.

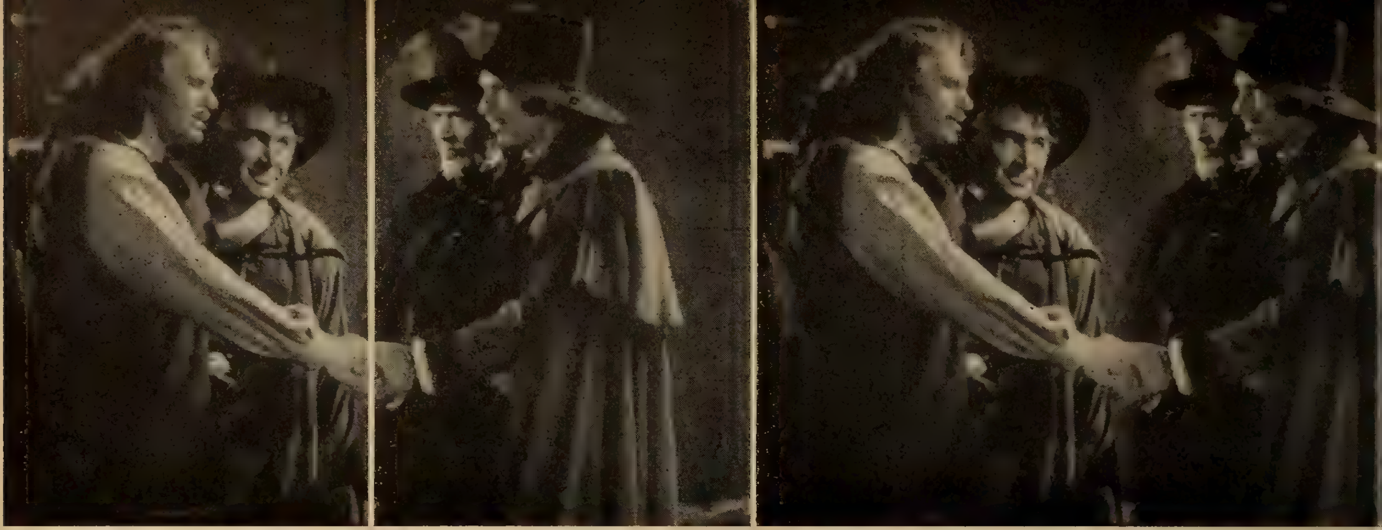
2 A. M. SHOW

St. Louis.—The Missouri theatre, 3,200 seater, gave its first 2 a.m. performance for defense workers, to an audience of 1,017. Men outnumbered the women in the audience by 5 to 1.

Police maintained a guard over the workers' autos to prevent tire thefts during the performance.

OUTSIDE SWITCHES ORDERED

Montgomery, Ala.—City authorities have issued rules that all business houses, amusement centers, etc., install outside switches so that lights may be turned off "simply and easily" by wardens or police if accidentally left on during future blackouts.



A *B* *C*

(A) shows the star while the mask obliterates the assisting double. (B) shows the positions reversed, with the mask still covering the new position of the double. (C) shows the combination of both takes using only those portions occupied by the star.

Dual Photography Matter of Timing

BY HOWARD ANDERSON

Have You Often Wondered How These Dual Roles Are Photographed? It Is All a Matter of Precision and Timing as shown in the Accompanying Article*

PERHAPS the easiest way to understand these dual effects is to tell of the earlier methods and compare them with the modern technique.

The early methods were taxing on the mental faculties and nerve-wracking. The art of making duplicate negatives was poorly developed, the dupes being grainy and of poor qualtiy; consequently all such effects had to be secured on the initial, original negative. Each time the film was run through the camera meant just that many chances for failure or accident.

The operation for dual roles:

The set was carefully designed, and a place selected with equal care for the line of demarcation. An opaque mask (or matte) was then placed in front of the lens, with the edge of the mask coincident with the imaginary line dividing the set.

The scene was then carefully rehearsed with the star occupying the part of the set not covered by the mask. Every spot along the entire strip of film was recorded by means of the footage counter or by counting the turns of the crank, after having marked the aperture (or frame) at the start of the scene.

A double played the responding part, occupying the side of the set hidden by the mask which protected that part of the film from exposure, and preserving that space for the subsequent exposure.

The film was then rewound at the original mark on the aperture, and with the counter at zero, as at the start, or the crank handle at the downward position.

The position of the mask was then reversed, as were the positions of the principal and his double; after such necessary changes in costume or makeup were made.

The scene was again rehearsed, each actor now assuming the other's role. They were assisted bv an assistant director who cued them by the frame counter.

A *B* *C*

A B C

Now when the negative was developed, both sides of the film having been identically lighted and exposed, and the mask having been skillfully set, the picture showed no signs of the split, and was as one exposure.

Thus, we had two separate series of action by a principal and his double, exposed alternately on a single strip of film, having obliterated the double in each take by the relative positions of the mask.

In this method, where the single negative was made at the time on the set, no one was able to tell whether or not a matte-line would be visible until after the development of the negative. To everyone's sorrow this was frequently the case and a whole day's shooting would be lost. Naturally, this technique becomes so expensive, coupled with high-salaried actors and present-day shooting schedules as to become next to impossible. As an interesting comparison, in "The Corsican Brothers," thirty-three shots were made in just the ordinary shooting time without the necessity of a single retake.

Now, the modern developments have greatly simplified some features of the process, but the rigid requirements of the sound department have equally complicated other features. We now have the optical printer and the refined methods and materials for making dupes; but we need the help of the numerical cues called out aloud to aid the actors. This calling of numbers would also record, and confuse the dialogue; and also the camera is now run by the synchronous or interlocked motors of the sound apparatus.

The modern method, while identical in principle, provides for the exposing of two negatives; the part with the double being eliminated by masking in the optical printer, (instead of the camera) and the two parts showing the principal, successively exposed onto a dupe negative stock. The optical printer provides for a high degree of precision, so as to show no line of demarcation.

Now, here is the interesting part: the dialogue is recorded during the first exposure; and the same time a wax playback is made. This playback performs the same office as was previously provided by the count method, and furnishes faultless cues for the action, because they are made synchronously with each exposure.

And further, as the double may be eliminated by the mask in the printer, so may both *sound records of the principal* be re-recorded on the single strip of sound track, eliminating the cuing dialogue of the double.

Apart from the interesting technical features, that of the artistic treatment is of the utmost importance.

Many such pictures have failed, because the assisting double has been poorly directed—the principal appeared not to be speaking to, looking at or otherwise reacting to the proper twin.

The success of "The Corsican Brothers" was due to clever collaboration between the writer of this article who was in charge of these effects, the director and Mr. Fairbanks; at all times his actions and reactions were beautifully timed and the results were convincing.

The modern method provides many interesting embellishments, such as, panoramic shots where the principal is followed across the room where he may appear in a doorway, or other likely place again; by reshooting the required portion from the static position, and combining them in the optical printer.

The modern method provides many other advantages. It is possible even to vary the position of the dividing line in a continuous scene, thus permitting the actors to move about the set. This changing of the line suggests the same principle involved in the so-called wipes.

Further, in many shots, two cameras, a closeup and a medium shot camera were employed for the same scene photographing at the same time, thus, giving the cutter extreme freedom in editing the film.

*Permission of International Photographer.

WITH THE COLORS

Each day the list of projectionists called to the colors grows longer and one wonders how long it will be before the theatres begin to feel the pinch.

A few of the many now working for Uncle Same are: R. Van Buren, New York; Fred Robinson, Seattle, Wash.; Joe Campanelli, Los Angeles, Cal.; N. L. Mower, Roanoke, Va.; William Brown, Pensacola, Fla.; Virgil Hickman, Wheeling, W. Va.; Sheldon Knight, Boise, Idaho; H. A. Keller, Lincoln, Neb.; A. A. Ansback, Jr., Louisville, Ky.; William Marcheck, Pittsburgh, Pa.; Pat Casey, Indianapolis, Ind.; Willard Sholes, Providence, R. I.; Charles Finch, Atlanta, Ga.; Leslie Arnold, Lake Charles, La.; Frank Toth, Bridgeport, Conn.; Joe Dolan, Columbus, O.; Byron Smith, Bradenton, Fla.; Emanuel Schifani, Albuquerque, N. M.; Buford Spauldin, Fort Smith, Ark.; Don Varell, Wilmington, Del.; Lester Jacque, Green Bay, Wisc.; J. P. Duich, Marshalltown, Iowa; Charles Hartley, Anderson, Ind.; James Will, Raleigh, N. C.; E. H. Levy, New York; Hays Caldwell, Miami, Okla.; Al Villa, New York; Lee Seaweek, Toledo, O.; S. T. Bloom, Hollywood; Richard Rank, Mount Clemens, Mich.; Irwin Ellis, La Junta, Col.

SEEK TELE PERMIT

Washington.—The Allen B. Dumont Laboratories of Passaic, N. J., is seeking a permit to construct a commercial television station. The company is partly owned by Paramount Pictures.

Suggested Classification of Carbon Arc Terminology As Applied To Pictures

This article presents definitions of the three general types of carbon arcs used in the motion picture industry, the distinction between them being based upon the origin and the character of the radiation in each case. In the low-intensity arc, the principal light-source is incandescent solid carbon at or near its sublimation temperature; in the flame arc, the entire arc stream, made luminescent by the addition of flame materials, is used as the light-source; while the high-intensity arc is one in which, in addition to the light from the incandescent carbon, there is a significant amount of light originating in the gaseous region immediately in front of the carbon. With these concepts as a basis, the theory of light generation in each case is presented with the object of further clarifying the distinction between the three types of carbon arcs.

By B. H. G. MacPherson

RESEARCH STAFF NATIONAL CARBON CO.

THE carbon arcs used in the motion picture industry are of three general types — the low-intensity arc, the flame arc, and the high-intensity arc. The low and high-intensity arcs have been used in both motion picture photography and in projection, although the former is now obsolete in photography and is steadily being replaced by the more efficient high-intensity type in the projection field as well. The most important use of the flame arc in the motion picture industry is in photography, where it provides a broad beam of suitable color quality for general set illumination. The system of nomenclature that has grown up with the industry is more descriptive of certain types of lamp than of the character of the arc. Names such as "mirror arc," "Hi-Lo," "Simplified High-Intensity," "M. P. Studio," "Baby Spot," and "Sun-Arc" are in common usage, but some of these terms are not descriptive of either the arc itself, the mechanism, the optics, or the service. It is the purpose of this paper to define the arc itself, irrespective of the other factors just mentioned, so that a given trim may be readily classified as to whether it is a low-intensity, a flame, or a high-intensity arc.

As a basis for classification, the physical nature of the light-source offers the most logical distinction. Therefore the definitions have been phrased from this standpoint, followed in each case by descriptive material in their support.

The Low-Intensity Carbon Arc.—The low-intensity carbon arc is one in which the principal light-source is incandescent solid carbon at or near its sublimation temperature.

In the vast majority of cases, this arc is operated on direct current, although a few carbons are still sold for alternating-current service. The direct-current arc uses neutral cored positive electrodes and either solid or cored negative electrodes. A neutral cored carbon contains a core consisting predominantly of carbon, less dense than the surrounding shell, and incorporating a small percentage of an arc-supporting material such as a potassium salt, which does not contribute significantly to the light. "White Flame A.C." carbons are used in the alternating-current, low-intensity arc. The core of these carbons contains flame-supporting material the function of which is to steady the arc, quiet the hum, and whiten the light. In the direct-current arc, the crater face of the positive electrode is used as the light-source for projection, since it operates at a much higher temperature than the negative electrode and so provides about 90 per cent of the total light from the arc. The bright spot on the end of this positive carbon has a rather sharply delineated boundary which is called the anode spot or the positive crater. This crater marks the region within which most of the electric current passes between the anode and the arc stream.

The surface of the crater is heated to its high temperature as the result of the absorption of energy from electrons discharged there, and the absorption of energy from the gaseous region known as the anode layer directly in front of the anode. The arc gas in the major part of the arc stream is very hot, having a temperature of 6000° C or more, and is therefore highly ionized. In its highly ionized condition, it can carry the current with a fairly low voltage drop per unit length, amounting to about 20 volts per centimeter. In the anode layer, however, the gas is cooled by the proximity of the anode to such an extent that its degree of ionization, and therefore its electrical conductivity, is very low. Because of its low electrical conductivity and because of space-charge effects, a high voltage drop must be concentrated in the region of this anode layer in order to force electrons through it and thus conduct the arc current. This voltage is called the anode drop, and is of the order of magnitude of 35 volts for a low-intensity arc.

This energy dissipated at the anode heats it to incandescence, the maximum temperature obtained being limited by the sublimation temperature of carbon. This limits the maximum brilliancy of the low-intensity arc to a value of about 175 candles per square-millimeter. The area of the anode spot or crater adjusts itself for a given current so that the heat input is sufficient to bring the crater to a value near this sublimation temperature. An increase in current in the low-intensity arc will, therefore, not increase appreciably the maximum brightness, but will increase the area of the crater surface. Compared to a high-intensity arc, the current-density of a low-intensity arc is quite low. For the familiar commercial lamps, the current-density in the positive carbon ranges from approximately 50 to 200 amperes per square-inch.

Ideal Material

It is interesting to observe that carbon is an ideal material for use as an electrode in such an arc, because it remains a solid at a higher temperature than any other substance of suitable electrical and thermal conductivity, so that a more brilliant light may be produced; while its property of volatilizing directly from a solid to a gaseous state permits convenient disposal of the consumed portion without danger to the associated mechanism.

The Flame Arc.—A flame arc is one

Theatres Are Facing Serious Problem In Unusual Wartime Situation

Increased Radio Audiences—Night Factory Work—Blackouts and Tire Shortage Bound to Reduce Theatre Attendance Materially. Millions of Men Inducted Into Army Also Will Cut Deep

A RECENT survey of theatre conditions indicates that the movie houses are taking it on the chin, due to a number of reasons. Although the situation has not reached a critical stage, it shows which way the wind is blowing.

Factors contributing to the theatre situation are increasingly large radio audiences; night work in munitions factories; blackouts, and tire shortages.

Since the Jap attack on Pearl Harbor radio audiences have increased more than ten per cent, with most of the increase during the evening hours when the movies would ordinarily receive their best patronage. It is estimated that when President Roosevelt gives a "Fireside Chat" over the air theatres suffer a drop as much as 40 per cent and it is expected that his "chats" will become more and more frequent as the war progresses.

Night workers in munitions factories, numbering high in the thousands, and constantly on the increase, leave a big gap in the ranks of habitual movie goers. In some districts, such as Detroit, a few theatres operate all night, but this is not general. It is estimated that within a short space of time more than a million men and women will be employed at night. These workers are all potential movie goers and there is no denying the fact that their absence will cut deep in theatre profits.

Blackouts Hurt

Reports from those cities that have tried test blackouts show a great drop in theatre patronage on the nights of the tests. These tests are becoming more and more numerous. In recent blackout tests in New York, theatres in the districts suffered as much as 60 per cent. Other cities report about the same number. Cities along the Atlantic and Pacific seaboards will feel the brunt of blackout regulations.

Every man inducted into military service is one less movie patron. Washington intimates that 5,000,000 American men will soon be under arms. These men under normal conditions would patronize the theatre twice each week. Also, women are being mobilized and millions soon will be giving their evenings to study and work and will give up their theatre habits.

The tire shortage, although it is not yet greatly felt, will make itself known as time goes on. Rural districts will feel the pinch, for farmers will save their rubber for commercial purposes rather than for amusement.

As yet there has been no wholesale closing of theatres due to diminishing business but as time goes on theatre operators will have to cut expenses if they are to keep their houses open. Since closed theatres means fewer jobs for projectionists, it is important that both men do everything in their power to economize.

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in which the entire arc stream, made luminescent by the addition of flame materials, is used as a light-source.

The flame arc was a natural development from the low-intensity arc, obtained by enlarging the core in the electrodes and replacing part of the carbon there by chemical compounds capable of radiating efficiently in a highly heated gaseous form. These compounds are vaporized along with the carbon and diffuse throughout the arc flame, rendering it luminescent. The high concentration of flame materials in the core reduces the area and brilliance of the anode spot so that, at the low current-densities used in flame arcs, the contribution of the electrode incandescence to the total light becomes unimportant. The evaporation of flame materials is slow relative to that obtained in a high-intensity arc, and the resulting concentration of flame elements in the arc stream is low so that a high brilliance does not result. Since the whole flame is made luminous, however, the light-source is one of large area and the radiating efficiency is high.

The radiation emitted by the flame arc consists chiefly of the characteristic line spectra of the elements in the flame material, and in the band spectra of the compounds formed. The rare earth metals of the cerium group are used as flame materials where, as in most cases, a white light is desired, while calcium salts are used to give a yellow light and strontium salts red.

The High-Intensity Carbon Arc.—The high-intensity carbon arc as used for projection is one in which, in addition to the light from the incandescent crater surface, there is a significant amount of light originating in the gaseous region immediately in front of the carbons as the result of the combination of a high current-density and an atmosphere rich in flame materials.

To produce a direct-current high-intensity arc, the positive carbon must be cored with chemical compounds similar to those used in flame arc electrodes. The current-density, however, is much higher, so that the anode spot spreads over the entire tip of the carbon, resulting in the rapid evaporation of flame material as well as carbon from the core. Since the flame material is more easily ionized than carbon, its presence in the anode layer results in a lower anode drop at the core area than at the shell of the carbon. This tends to concentrate the current at the core surface, resulting in the hollowing out of a crater as the current is increased. The rapid evaporation of the flame material produces a high concentration of this efficiently radiating gas in the crater and immediately in front of it. This gas, of course, radiates in all directions, even back toward the crater surface, and consequently tends to serve as a blanket preventing the radiative cooling of the crater face. The heat liberated at the crater face must then be dissipated entirely through evaporation of more flame material and through conduction back along the positive carbon. This, of course, tends to increase the evaporation of material within the crater and aids in the tendency for crater formation. Thus in a high-intensity arc there is a close correlation between the crater depth and the brilliancy of the arc gas within and immediately in front of the crater; for a given type of positive carbon, there is a linear relationship between the crater depth and the excess brightness over that of a low-intensity arc.

An increase of current in a high-intensity arc increases the crater area only slightly, but produces a marked increase in brilliancy. The maximum brilliancy of the crater obtained in various types of direct-current high-intensity arcs used in common commercial lamps ranges from 350 to 1200 candles per square-millimeter with current-densities in the positive carbon ranging from 400 to well over 1000 amperes per square-inch. Experimental carbons have been produced with brilliancies in excess of 1500 candles per square-millimeter.

The increased brilliancy of a high-intensity over that of a low-intensity arc is produced by radiation from the high concentration of flame materials within the confines of the crater. The thermal energy supplied by the electrical power input to the arc continually excites the atoms of the flame materials to higher energy states, and the excess energy of these atoms is being continually released

(Continued on page 22)

Television In Theatres Long Way Off According To Experts

Many Bugs to Be Eliminated Before Tele Can Offer Any Serious Competition to Films—Experiments to Continue in Spite of War

MOST theatre owners and projectionists are mightily interested in just how far television is going to affect the theatres and whether or not it will eventually prove an asset or a liability.

According to the leading engineers in the television field, there is no need for alarm concerning tele. In the first place, it is still in its infancy and there are so many "bugs" to be ironed out it will be years before it can become a competitor to the theatre. Again, it may become an asset through its adaption to the theatres themselves.

Up until a few weeks ago the Federal Communications Commission was weighing whether or not to completely block television research and expansion until after the war. This was due largely to the fact that priorities would cut deeply into the necessary equipment for experimental purposes. Pressure was brought to bear on the Commission and it was finally decided that tele could play a large part in winning the war and the industry should be permitted to function. That is the current status.

Experiments will be carried out by television experts in the Army Signal division to determine its value in war times. This means that despite priorities the industry will carry on and develop the new science.

Although television has been successfully tried in theatres it has not yet reached the stage where it can be considered ready for this purpose. The machines are too costly and there are too few operators educated to this new form of amusement. It is believed it will take years to educate enough men to take over this work. The army may train a number of men who, after the war, can be considered experts in this field. There is no doubt that many picture projectionists inducted into the army will be assigned to the Signal division and these will form the nucleus if and when television is adapted to theatres.

Again, it is reported that television will never be more than an adjunct to the theatre and will be confined largely to news shots and special events. It is not likely that picture companies will ever go to the expense of producing features exclusively for television. In the first place they have too much tied up in theatres and then they could not produce nearly enough pictures for this purpose exclusively.

For several years RCA has been televising movies for home receivers and, although they have had minor success, the small screen hampers the efforts. Up until a few months ago an average of five pictures were shown weekly, mostly shorts and serials.

It is the opinion of experts that home receiving sets will not offer any serious competition to theatres for years. In the first place there are too few receivers in the homes and no more will be built until after the war. Television broadcasters have a long way to go before they can cover the country, inasmuch as the average distance that a vision can be sent is now about 30 miles, or the distance the eye can reach from a high elevation. This means images will have to be picked up every 30 miles and sent another 30 where it is again picked up. The expense of receiving and sending stations will be enormous and there are those who believe that only with a government subsidy can stations cover the country.

Again, there is the matter of static in television as in radio. The theatre public is educated to perfect images on the screen and they are not going to be satisfied with distorted television images. When they pay their money at the box office they demand, and obtain, perfection.

It is understood that the Bell Telephone laboratories is working on a method of sending television images by wire, thus eliminating interference from static and other natural causes. RCA is reported to be working on both wireless and wired television and will probably combine the best features of each.

The fact that Paramount Pictures is interested in the Dumont television laboratories and has applied for an experimental television permit from the government, is an indication that the film people are aware of television possibilities and are not going to be caught napping.

It is impossible to determine how many motion picture projectionists are following the television trend and its relation to the amusement field. It is known, however, that most projectionists have long been interested in radio and they will soon convert their attention to the new field. No one can be sure what is going to happen, but it is best for operators to be prepared for any eventuality.

24 HOUR SHOWS

In order to accommodate night defense workers several Fort Worth, Texas, theatres of the Interstate chain plan to operate on a 24 hour a day basis as an experiment. If it works out the plan will be continued.

The first all night show for Rochester, N. Y., was launched recently at the Lincoln. The house will be open three nights a week for the present. The theatre is near the Eastman Kodak and Delco plants, employing nearly 10,000 defense workers.

PROJECTIONIST FOR COUNCIL

Lynchburg, Va.—William Callahan, local projectionist, has announced his candidacy for city council.

OPERATOR BURNED

Winchester, Ky.—Fire which caused several thousand dollars damage to the Town Hall theatre, also injured projectionist Ernest Kimbrell. He was burned about the head and shoulders while fighting the flames.

ADELBERT PETTIT DIES

Adelbert Pettit, Atlantic City projectionist, is dead following an operation. He was 35 years old.

NON SYNCH PHONOGRAPH

(*Continued from page* 13)

music over the marquee through the medium of an extra loudspeaker or so temporarily switched into circuit in place of one or more of the screen speakers. Special recordings made by the theatre, and adapted to its own conditions, should be unusually effective in this application.

Smaller theatres that do not want to go to the expense of a public address system sometimes feel themselves debarred from offering occasional spots of personal entertainment. As a matter of fact, with a non-synch and its associated announcing microphone, they have a passable substitute for a public address system, all complete, in their projection room. If the screen speakers must be struck to provide stage space, they will need supplementary loudspeakers mounted above or to either side of the proscenium. If the normal screen speakers can be left in place, they need nothing they do not already have.

Lubrication of High Temperature Lighting Devices With Graphite

The characteristics of colloidal graphite and its use as a high temperature resisting lubricant for searchlights, motion-picture projectors, lamp sockets and other lighting devices operating under heat conditions.

By BERNARD PORTER

RESEARCH LABORATORIES,
ACHESON COLLOIDS CORP.

THE relatively high temperatures generated about many lighting devices impose difficulties when lubricants must be used. Most mineral oils decompose under these conditions and form gum-like deposits. Artificial graphite, however, colloidalized and dispersed in liquids, supports lubrication at high temperatures. The graphite component will risist oxidation up to temperatures of about 1000 F in contrast to lubricating oils which oxidize so rapidly at that temperature as to ignite spontaneously. When applied to precleansed surfaces the liquid carriers of the colloidal dispersions evaporate, leaving an unctuous graphitic layer.

How graphite lubricates has been more fully understood as a result of close investigation by X-rays and electron diffraction methods. From the definition and thickness of the rings appearing in the diffraction pattern, workers are able to measure the individual graphite crystals. They find the average width, for example, is somewhat more than 10 millimicrons and the thickness in the order of 2 millimicrons. These research tools also reveal that the atomic structure of graphite is made up of atoms ranged at the corner of hexagons which in turn are placed in parallel sheets. The hexagons in adjacent sheets, however, are not symmetrically over one another but correspond alternately. This arrangement gives rise to a weak affinity of one plane of atoms for another; graphite, therefore, slips when rubbed into thin plates which subdivide as the action continues.

The same methods of examination show that graphite particles of colloidal dimensions (*i.e.* less than one micron — 0.00003937 inch—in size) combine physically under rubbing action with the metal structure of a friction face and form thin, imbedded surfaces having high slippage or lubricating properties. This "graphoid surface" consists of flat particles of graphite lying with their slip planes parallel to the metal face. In such a position they protect the underlying base from corrosion and metal to metal contact, or binding.

Engineers have combined these features of temperature resistance and lubricity with the inherent electrical conductivity of colloidal graphite for the specialized treatment of high-intensity searchlights, arc lamps and similar lighting devices which will now be discussed.

High-Intensity Searchlights

Temperatures as high as 900 F prevail in the operation of high-intensity arc mechanisms like the Sperry 60-inch type searchlight. Under this condition the ready mechanical movement of the carbon feed gears and bearings which automatically maintain the arc requires special attention from the lubrication standpoint.

Numerous experiments with many blended preparations have resulted in the following satisfactory mixture: 1 part by volume of concentrated colloidal graphite in water mixed with 10 parts of distilled water. This solution is shaken thoroughly and applied by atomizers every 200 hours directly onto the hot lamp parts. The liquid carrier immediately evaporates leaving a dull, black-matted surface of heat-resisting graphite, which assures free mechanical action. No binding or unsightly gumming deposits were found as was the case with the majority of preparations tested.

Motion-Picture Projectors

The same formula is also adaptable for the lubrication of the moving parts of Brenkert-type arc lamps used in the projection of motion pictures. Both the positive and negative heads of the arcs are coated by atomizing or painting with the dilute graphite solution. It was noticed that binding is almost wholly eliminated.

The combined features of an electrically-conductive lubricant, an effective parting compound and a corrosion preventative are required of retractible parts preparations; thus, threads, flanges, gaskets and other threaded pieces in the light assembly are treated in preparation for ultimate removal. One part of colloidal graphite mixed thoroughly with four parts of distilled water is an ample dilution for such treatment at the time of assembly.

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(*Continued from page* 19)

in the form of radiation. The high density of radiation results in the production of a strong continuous spectrum in addition to the line spectrum of the flame elements. Since radiation in the visual range of wavelength from 4000 to 7000 Angstroms is required in motion picture services, the most efficient compounds to use as flame materials are those producing the most radiation in this spectral band. Nothing better than the rare earth metals, of which cerium, lanthanum, neodymium, and praesodymium are typical examples, has ever been found for this purpose. With complex atoms having many electrons, countless opportunities for the energy exchanges that give rise to radiation in the visual region are provided, so that no one part of the spectrum is unduly exaggerated, and a white light is naturally produced.

The alternating-current high-intensity arc is also a true high-intensity arc within the meaning of the definition proposed. The high current-density and the high concentration of flame materials combine to produce light both from the incandescent electrode and from the gaseous region immediately adjacent, as they do on direct current.

Summary.—The fundamental distinction between the different types of arc is based upon the origin and character of the radiation. The chief contributing factors associated with this are composition of carbon, current-density, and brilliancy. The low-intensity arc is one in which the principal light-source is incandescent solid carbon at or near its sublimation temperature. The high-intensity arc is one in which in addition to the light from the incandescent crater surface there is a significant amount of light originating in the gaseous region immediately in front of the carbon. In the flame arc the entire arc stream, made luminescent by the addition of flame materials, is used as the light-source.

THOMAS AT TULLAHOMA, TENN.

Tullahoma, Tenn. — Leo Thomas has been named chief projectionist for the Cumberland Amusement Company's Strand theatre here. He was formerly with Pal Amusement Co., Vidalia, Ga., and the Strand, Jesup, Ga.

PRIORITIES HIT STUDIOS

Washington.—A group of motion picture executives visited here recently to determine where they stood regarding new studio equipment. After waiting around a week they were told there would be no equipment available for the duration and that studios must nurse their old equipment along.

Many studios looking ahead had ordered, and received, much new equipment and parts and will not be hurt but others, less far-seeing, are caught napping and will have to borrow or do the best they can with what they have.

Many studios are even saving old nails and bits of wire that formerly was swept up and discarded as refuse. Studio walls are covered with signs asking employes to cooperate in saving all material.

$75,000 BLAZE

Montreal.—The Palace, a thousand seater, in this city, was gutted by fire and will be a total loss. The damage is estimated at $75,000. There were only a few customers in the house at the time and all got out safely.

The theatre was a neighborhood house owned by Gorson-Lane Circuit, operating seven theatres in and around Montreal.

It is doubtful if the house will be rebuilt due to the inability to obtain the necessary materials.

Theatre owners here are keeping a sharp check on their houses and eliminating fire hazards for they know that even a minor blaze may force the house to close until after the war.

SPRINGFIELD THEATRES IN BLACKOUT TESTS

Springfield, Mass.—A new system of air raid warnings for theatres was put into operation successfully during last week's blackout, according to the director of public safety for the amusement industry division in Hampshire, Hampden and Franklin counties.

The procedure is for the alert center to telephone the theatre most centrally located in its region. This theatre is responsible for sending messages to other specified theatres located in its vicinity, and these, in turn, send messages to the remaining theatres and places of amusement. In this way the use of the telephone is reduced to a minimum inasmuch as only one call from the alert center is required for the notification of all theatres and places of amusement, except in larger regions where it may be necessary for the center to call two theatres. In Springfield, two downtown theatres were contacted by telephone and a complete blackout of the theatres was accomplished in less than three minutes.

The report from deputy safety directors indicated that theatre audiences remained quietly in their seats when notified a blackout was in progress. This was in contrast to the first blackout in which many patrons left their seats to see what was happening. Audiences are notified by means of a brief film announcement which is on hand in the operating booths of the theatres and can be thrown on the screen within a few seconds after receiving an air raid or blackout alarm. All reports stated that the theatre blackouts were completely successful, and received the commendation of the local safety inspectors.

(Continued from page 21)

Lamp Bases

The corrosive gases and other foreign bodies in the air of industrial plants, the prevailing dampness of cellars and storehouses, and the salt air on board ship or along the seaboard are responsible for the corroding of incandescent lamp bases in their sockets. It was found that this difficulty could be overcome by applying to the threaded portion of the lamp base colloidal graphite suspended in water, which not only forms a dry lubricant but is also an anti-corrosive agent. The surface to be treated, after having been cleansed of grease, can be covered with this solution by spraying or brushing. Lamps and fuse plugs so treated should not be screwed into their sockets until the graphite film is thoroughly dry.

Other Applications

Colloidal graphite is not a new material to illuminating engineers and lighting designers. Its service as a clamping paste for cementing carbon filaments to base leads in carbon lamps is well known; it has been a standard diamond-die lubricant for drawing tungsten and molybdenum filaments since 1906. Besides the application of colloidal graphite solutions to the specific lighting devices already mentioned, engineers are developing other uses.

The design and formation of permanent lens shutters are currently being investigated. The opacity of dried graphite films and their tenacity to precleansed glass surfaces make it useful in this case. Thus, the vertical sectors of molded glass lenses may be easily painted with this material for special optical and lighting purposes.

PACT, RETROACTIVE TO JULY, GIVES 4-MILLION WAGE RISE

A BASIC working agreement covering wage scales, hours and working conditions for ten motion picture studio craft unions affiliated with the I.A.T.S.E. has been negotiated by union officials and representatives of the eight leading film-producing organizations. Although the joint statement issued by the producers and the Alliance did not specify details of the contract, it was reported unofficially that the unions affected thereby would receive a blanket wage increase of 10 per cent. This would amount to $3,500,000 to $4,000,000 a year.

The contract, concluded after sixteen days of negotiation, runs for two years and is retroactive to July, 1941. The crafts involved are the make-up artists, studio projectionists, wardrobe departments, propertymen, grips, sound men, lamp operators, camera men and laborers. Altogether it is estimated that 10,000 workers will benefit by the new agreement.

The negotiations were unique in film labor history in that representatives of the ten locals actually handled the negotiations themselves. General Office representatives participated as observers and consultants. Moreover, each group negotiated openly in the presence of each other. Heretofore the individual locals had conducted their business behind closed doors.

It was suggested that the retroactive pay be presented to the workers in the equivalent of defense bonds or stamps.

WASHINGTON HALTS NEW THEATRE CONSTRUCTION

Washington.—All theatre construction for the duration has been ordered by the War Production Board. It has been hinted for some time that the government would soon call a halt in new theatres since so much steel and other essential material goes into this type of construction.

Although the order at present applies only to theatres on which actual work has not already started, but theatres in the process of building are to be examined on individual basis to determine whether or not they are absolutely essential to the neighborhood in which they are situated.

There are now more than 17,000 theatres in operation in this country and the Board believes this is a sufficient number to take care of the needs of the nation until the war is over.

See Page 3

DETROIT THEATRES HAVE PLANS FOR AIR RAID ALARMS

DETROIT.—A set of rules for theatres during blackout periods has been introduced here and it is a model that will probably be followed by other cities.

Responsibility for each individual operation is placed directly on the man who can do it best, and each employee, in general, is assigned duties in accord with his familiar range of work, so that each is familiar with and skilled in the use of special routine or equipment. Each house manager, for instance, is responsible for preparing his own detailed manual, based on his own house conditions, but co-ordinated through the basic circuit manual. Strong emphasis is upon not sending any new man on duty even for an hour, until he knows the special air raid duties of his assignment.

Emphasis throughout is on moving unhurriedly and making any necessary announcements calmly, using traditional show business technique to avoid panic.

Only the senior executive on the floor at the time is given authority to call an alert. Use of such terms as "air raid," "fire," or "bombing" is forbidden at all times, to avoid panic, and a special code phrase is used to notify the staff by word of mouth of conditions. In case of an "alert" when the authorities request the audience to remain inside, a verbal announcement is to be made by the senior executive from the stage, and he may then determine whether to have the operator continue the show, or let the audience stay in the house but keep lights up.

Each individual employe is given detailed instructions to protect both life and property, including ticket takers, candy girls, spotlight men, stagehands, cashiers, ushers, etc. Darkening all outside lights and switching on emergency lighting in anticipation of power failure are called for, for instance. The operator is to stop the show when the warning is given, and stage hands to turn on house lights and close the curtain, and then stand on the stage in sight, in order to aid in calming the audience. Roof watcher is provided for.

In the case of an order from the authorities to clear the house, special precautions to clear the exits are to be taken, such as clearing away the ticket box. The operator is instructed to remove all film from machines and place in cans, and stage hands, when instructed to drop the asbestos curtain. The engineer is instructed to stand by for special control of heating and ventilating equipment as ordered.

FLAME-PROOFING LAW MAY BRING CUT IN INSURANCE

Detroit.—New State law may mean ultimate reduction in insurance rates for Michigan exhibitors. New law requires flame-proofing of all draperies, curtains, and similar equipment. According to Arnold D. Dickerson of Theatre Screen Corp., a 15 per cent reduction in Detroit rates, where similar rules have been in effect for some time, already has been secured, and a future 15 per cent reduction is being sought as well.

Enforcement under the new law is in the hands of the State Police, who may make inspection at any reasonable hour, and may secure court priority on such cases for immediate enforcement. The Police Commissioner may then order a theatre closed in case of non-compliance, or have the required work done and charged as a lien against the property, like taxes.

COPPER CONSERVATION

A commendable and patriotic activity of copper conservation was started early in December by the members of Local 143 of I.A.T.S.E., St. Louis, by stripping the copper plating off the butt ends of used copper plated projector carbons and by saving all the copper drippings which accumulate in the projector lamp house. The copper thus saved is turned over to local salvage organizations or sold to regular metal scrap dealers where it in turn can find its way back into use for Defense purposes.

This is an extremely important effort and should be given immediate consideration by projectionists and exhibitors throughout the country. It is possible by concerted action on the part of all concerned to thus conserve a large percentage of the copper used by the industry and to effect a very worthwhile saving of this vital metal.

It is hoped that this idea will spread quickly and that the industry will respond with its fullest cooperation.

306 NAMES DELEGATES

New York.—Herman Gelber, president of Local 306; Nat Doragoff, Charles Beckman, Joseph D. Basson, Morris Kravitz, newly elected business agent succeeding Bert Popkin, resigned; Ben Seher, Steve D'Inzillo, James Ambrosio, Wallace Burns, Edgar Stewart, Jack Tiegler and Alexander Polin have been elected delegates to the IATSE biennial convention to be held June 1 in Columbus.

A REAL GRIND

The Ridge Theatre, Chicago, has adopted a triple feature schedule and reduced admission to 18 cents. The booth is so full of cans the operators will have to reduce their weight to get around.

10 CHI. OPERATORS ENLISTED IN NAVY

Chicago—Ten members of the local operators union were enlisted in the Navy in one day recently as second class electricians. They will man equipment in film theatres at the Great Lakes Naval Station.

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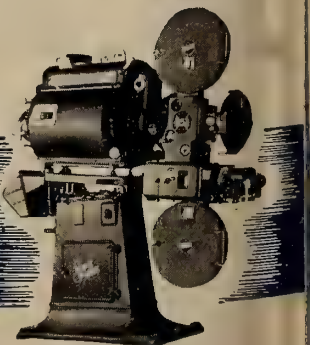

INTERNATIONAL PROJECTIONIST

FEBRUARY 1942

VOLUME 17 • NUMBER 2

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TO PROJECTIONISTS!

Visitron cells are available for every type of sound projection equipment. Theatre supply dealers can advise the correct cell for your equipment. Buy from your supply dealer. If you wish to have your old cells tested without charge, write to G-M Laboratories, Inc., for instructions for shipping. Information furnished promptly.

I know all about it . . . even if I did learn too late.

You think theatregoers don't know the difference in low and high intensity projection? That's what I thought. So why am I closing the place? Because my thinker wasn't clicking.

I thought that I'd save the cost of new high intensities, even though they didn't cost much. So what? It cost me more than I thought I'd save. Business kept getting worse. People wouldn't come even on the better pictures.

And what about this thing of showing Technicolor pictures with low intensity lamps? Well, just this. It's the beauty of colored pictures that sells the extra tickets, and people can't see much beauty in bilious pictures of green skies, yellow snow, and orange colored Santa Claus. Colors, yes, but not the kind that people want to see. But they're what you have with the muddy yellow light of the low intensity lamp.

And don't think you can keep blaming the exchanges for those "dark" prints. All prints are dense today and unless you double your screen light with one-kilowatt lamps, your projected pictures will always be dim.

So you'd better light up your screen or lock up your doors as I'm doing.

Your Independent Theatre Supply Dealer will give you even more reasons why you should install Strong Utility High Intensity Projection Arc Lamps now. See him or write The Strong Electric Corporation, 2501 Lagrange Street, Toledo, Ohio. Export Office: 90 Gold St., New York City.

International PROJECTIONIST

With Which is Combined Projection Engineering

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Monthly Chat

NEW vistas for the projectionist are now being prepared in laboratories secretly devoted to improving war machinery. Almost everyone knows that the talking picture is the grandchild of the last war. It is a child of radio—which in 1918 was called the radio-telephone. The communications needs of that other war changed the radio-telephone from an experimenters' hobby to a practical commercial commodity.

What this war is developing that will enter into the theatre when peace returns remains wrapped in smokescreens for the duration, but television infinitely improved beyond that of a year ago is one large-scale development almost certainly to be expected. Vast improvements in tubes, new tricks in arc lamps, altered amplifier circuits, better loudspeakers, are obvious small developments. And there may be some large, staggering inventions—as revolutionary as the talking picture.

The projectionist who doesn't want to be taken too much by surprise may give some serious thought to brushing up his knowledge of the basic science of electricity and related arts. No one can study up now on the secret details of military secrets—or know in detail how they will ultimately affect the theatre if he could. But there will certainly be no miracles; whatever is accomplished will rest on sound scientific fundamentals. Personal preparation for a future that will prove very different technically, can be achieved by plugging any existing gaps in technical education and background. Every additional scrap of knowledge will obviously help in dealing with the projection room shortages and emergencies of war conditions, but beyond that, will constitute the only possible preparation, and the best preparation, for the surprises that are bound to come out of the war factories when the shooting is over.

• • •

We have in mind a couple of manufacturers who hold the view that projectionists exert no influence at all in the purchase of room equipment. Unless we are convinced shortly that these fellows have experienced a change of viewpoint (the convincer to take the form of some ad copy directed to projectionists instead of exclusively to the exhibitor, who hardly knows the difference between a p. e. cell and a feed-screw) we might be forced to disclose the identity of these people who hold the craft in such low esteem.

INTERNATIONAL PROJECTIONIST

VOLUME XVII FEBRUARY 1942 NUMBER 2

Factors Affecting Sound In Theatres†

BY ADOLPH GOODMAN
MEMBER, TECHNICAL STAFF, RCA MFG. CO.

In Spite of Improvements, There Is Much to Be Desired From Audience Viewpoint — Important Factors to Study—Operator Must Be on His Toes to Get Results

DURING the past ten years a great deal of technical progress has been achieved in recording technic, and in recording and reproducing apparatus so that today these advances should be reflected in greater entertainment value of the motion picture. In spite of such improvements there is much to be desired in the final presentation in theatres, mainly because there is a lack of proper coordination between the various phases that go to make up the ultimate sound as heard by the audience.

We shall point out the factors that must be considered and how they affect each other from the standpoint of the presentation in the theatre. Assuming that the sound-track on the film is a faithful record of the original sounds, final results that the theatre patrons hear depend upon the following five important, closely related factors:

(1) The sound-reproducing system.
(2) The theatre acoustic condition.
(3) The screen.
(4) The adjustments of the sound system.
(5) The operation and maintenance of the sound system.

The Sound-Reproducing System

It is fundamentally important that the sound-reproducing system be adequate, since it is through this medium that the audience is expected to hear sounds as the studio directors and technicians originally conceived them. It is well known that inadequate sound reproduction can ruin an otherwise excellent picture, while sound properly reproduced adds greatly to the entertainment value of the motion picture action.

In the early days, equipments having output power up to 10 or 12 watts were considered satisfactory, while in many instances the power available was as low as 1 or 2 watts. Modern presentation of sound motion pictures requires considerably increased power for proper dramatic effects, and it is not unusual for the larger theatres to use as much as 150 watts of undistorted power. Even greater power is needed for showing pictures such as Disney's *Fantasia* for creation of effects designed to stimulate the audience.

Realism in sound effects adds tremendously to the appeal of the screen action. Earthquake and warfare scenes must have sound accompaniment loud enough to make the audience feel that they are actual spectators at the scene of action Thus, the small theatres as well as the large ones need apparatus having many times the power considered adequate in the past.

The Society of Motion Picture Engineers and the Academy of Motion Picture Arts and Sciences have studied the requirements for adequate theatre sound equipment to meet the needs of modern pictures, and the following specifications represent the results of these studies:

(1) Volume range of 50 to 60 db.

(2) Amplifier capacity in accordance with recommendations of Academy of Motion Picture Arts and Sciences. (See *Research Council Bull.*, June 19, 1940.)

(3) Frequency response of 50 to at least 8000 cycles, with provision for extension to 10,000 cycles.

(4) Stage loud speaker system should have a high degree of efficiency, so that the required amplifier capacity need not be too great. The loud speaker system should have proper angular distribution so that all frequencies can be properly distributed throughout the theatre.

(5) The sound-head should have a "flutter" content imperceptible to the ear.

(6) The equipment should be easy to install and operate. Necessary operating controls should be accessible.

(7) Components of apparatus should be easily accessible for maintenance and service operations.

(8) Adequate emergency provisions should be incorporated.

(9) Provision should be made for addition of apparatus that may be required in the future due to advancements in the art.

†J. Soc. Mot. Pict. Eng.

Regardless of how well sound is reproduced by the stage speakers, the theatre acoustics greatly influence the final result. If a theatre is properly designed acoustically, it will allow the sound to arrive at the listeners' ears with naturalness and realism. If the theatre has any acoustic defects, the sound may be so changed in character that it arrives at the listeners' ears harsh, distorted, and very unsatisfactory.

In view of the technical progress that has been made in both recording and reproducing apparatus, it is more important than ever before that careful consideration be given to the acoustic design of the theatre. This is necessary in order to take full advantage of the ability of modern equipment to give a faithful reproduction of the original sound.

Some of the more common defects found in auditoriums that are detrimental to good reproduction are high reverberation-time, echo, resonance, and extraneous noise from auxiliary equipment, or noises from sources outside the theatre. Many of these can be overcome or eliminated by proper consideration of such problems in the original design. Specifically, attention should be given to the shape and size of the theatre, the location and frequency characteristics of absorbent materials, and the insulation of walls and air-conditioning ducts to minimize the transmission of noise to the auditorium proper.

Fortunately, the present trend is toward coordination between acoustic treatment and the other functions of the auditorium such as lighting, decoration, air conditioning, *etc.* Thus the theatre architect can carry out a definite decorative scheme and at the same time incorporate the necessary provisions to make the theatre suitable from an acoustic standpoint.

Screen

After the sound leaves the loud speaker system it must pass through the screen before reaching the audience. Just as the acoustic condition of the theatre plays an important part in the final result, so does the screen influence the sound as heard by the listeners.

One of the improvements made in modern sound equipment is the extension of the upper audio-frequency range. A poor screen will not allow the high-frequency tones to be transmitted with the proper intensity, resulting in a loss of brilliance of the music and lack of intelligibility of speech.

The sound-transmission properties of a screen depend upon several factors, the most important of which the size and number of perforations per square-inch and the thickness of the screen material. If the holes are too small or the material is too thick, then the screen presents too high an acoustic impedance to permit good sound transmission.

Even though a screen may be satisfactory when first installed, it may adversely affect the sound transmission after a period of use. The perforations will gather dust, and eventually the hole diameters will be restricted, causing a reduction in high-frequency transmission. More frequently loss of transmission qualities are due to resurfacing the screen, in an attempt to improve the light-reflecting qualities. Any attempt to overcome such adverse conditions of the screen by recompensating the sound system to accentuate certain frequency bands results in ragged response and uncomfortable hearing conditions as far as the audience is concerned.

Adjustments of the Sound System

While present-day theatre sound apparatus is capable of reproducing with greater fidelity, the various components must be more carefully installed and adjusted than has heretofore been necessary. Low-level circuits should be carefully shielded and grounded to prevent the introduction of extraneous noises into the system. Correct power-transformer taps should be used, depending upon the line voltage. Voltages and currents in tubes, exciter lamps, and loud speaker fields should be checked to be sure they conform to specifications. In addition, the mechanical apparatus should be carefully inspected, oiled, and adjusted before any film is run. After these preliminary adjustments have been made, then the amplifier system should be set to conform to the frequency response characteristic set up for that particular system. Experience with a large number of installations has shown that the standard electrical characteristic will prove to be satisfactory in the vast majority of theatres.

To secure uniform frequency balance, proper distribution of high-frequency tones, and equalized volume levels in the various parts of the theatre, it is necessary to pay special attention to the installation and adjustment of the stage loud speaker system. One of the most satisfactory speaker set-ups is that in which the high frequencies are reproduced by a cellular type of horn and the low frequencies by some type of folded horn, with a suitable cross-over network to separate the two frequency bands properly. Since frequencies above 300 cycles become directional and beyond 2000 cycles have a beam effect, the positioning of the high-frequency horn is extremely critical in arriving at the best setting for uniform sound distribution. Also, the high-frequency horn must be properly set with respect to the low-frequency unit to obtain the correct phase relation between the sounds emanating from both sources. Usually, this dimension is specified by the manufacturer, but the actual relative positions are subject to slight variation in practice and must be checked during the tune-up process.

Maintenance of the Sound System

At present, the most satisfactory means for adjusting the balance and distribution in the auditorium is by use of the Academy Research Council Theatre Sound Test-Reel and by careful listening tests in all parts of the theatre. Since the test-reel contains selections of regular release prints from the various major Hollywood studios, once the equipment has been adjusted properly, it will reproduce the product of all studios with uniformly good quality.

The preceding discussion pointed out how the condition of the theatre and the equipment affects the sound reproduction. Of equal importance are the operation and maintenance of the sound system. Since the apparatus consists of delicate mechanical parts and sensitive electrical circuits, it must be kept in good condition at all times.

An important point in practical operation is the setting of the sound volume level for the auditorium to allow the audience to hear comfortably. It must be remembered that the frequency response of the human ear changes for different sound levels. When the response of the sound system is adjusted for proper balance between high and low frequencies for a certain optimal level in the auditorium, the pictures reproduced at this level are natural and pleasing. However, if the average level is increased or decreased, the sound quality changes appreciably and the balance is destroyed. Generally, if the level is set too low, the sound loses "screen presence," giving the impression that the actors are far behind the screen. If the level is too high, certain features of voice reproduction are over-accentuated and the sound becomes extremely irritating, (*e. g.*, excessively strong sibilants). Projectionists can determine the average gain setting for their theatres that will give the most pleasing and understandable sound. Once this has been determined, there should be no necessity for "riding" the gain control during the showing of a picture.

Because of the many delicate adjustments that must be maintained it is extremely important that the equipment be inspected periodically.

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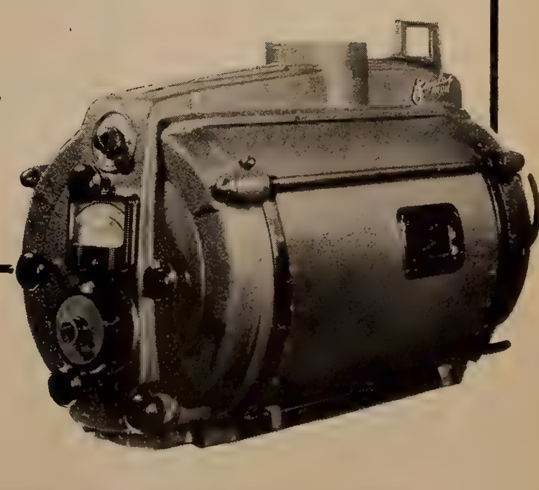


Keeping the Show Going When Needed Replacements Are Delayed

BY LEROY CHADBOURNE

Some Simple Rules That May Lift You Over a Tough Spot When a Breakdown Comes—Operators Will Have to Be Ingenious to Keep the Show Running Under Unusual Circumstances

DELAYS in supplying replacement parts, which must be expected from now on, will make necessary some changes in customary methods of dealing with projection room emergencies. In the past, many troubles were dealt with on a basis of delay-plus-permanent repair. For example, if a loudspeaker unit failed in a theatre having more than one set of loudspeakers: unless a replacement unit was actually on hand as a rule nothing was done except to wait till one arrived, while the show went on with weak sound in one group of seats. That condition can be more or less tolerated for a day, but not for many days. Some interim arrangement must be used—that is, the delay-plus-permanent-repair procedure must become one of delay-plus-temporary-repair-plus-permanent-repair.

Also, where temporary repairs of one kind or another were used in the past they were often emergency measures that did not produce very good results, or were not very safe, but desirable for a few hours or perhaps a day. Here still another interim step may be needed, one that can be described perhaps as a semi-temporary repair. For instance, failure of an amplifier filter condenser was occasionally treated simply by disconnecting the condenser, operating without it at the expense of some hum in the sound. Here again, if the replacement condenser arrives before the start of the next day's show, or in some similar short period of time, no very great harm is done; but if the theatre is going to have to run for many days, or for weeks or even months with an annoying hum coming from the loudspeakers an interim repair becomes imperative.

In short, unless the theatre wants to lower its former standards quite materially, and run on a sloppy basis, the projectionist may have to teach himself some new tricks to meet new conditions.

One very obvious precaution is, of course, to lay in an ample stock of spare parts. There are two exceptions—the "wet" type of electrolytic condenser is somewhat subject to deterioration on the shelf, and the common dry cell or battery very much so. Other condensers, and of course resistors, transformers, tubes, lenses, projector parts and so on can be stocked indefinitely, and so can loudspeaker units, photocells, exciter lamps, fuses and a host of other items.

But it isn't practical for a theatre to stock everything, in quantities sufficient for an abnormal condition of indefinite duration, hence the problem still comes back to the resourcefulness, ingenuity and detailed knowledge of the projectionist. There isn't any solution except for the projectionist to take the responsibility of maintaining his theatre's standards of performance even when he doesn't have a needed part and can't get one without considerable delay.

Prepare for Trouble

In every trouble small or large that the projectionist encounters from now on, even though his repair part is on hand or delivered promptly, he may do well if he gives some thought to how he would handle the same trouble if it occurred again and the regular replacement part could not be obtained for a long time. He may also think back over troubles he has met and cured in the past, from the same point of view.

In the case of the amplifier filter condenser just mentioned—what can be done? Obviously, some kind of condenser will have to be installed. It may not be just what is needed, it may not take out all the hum; but at least something must be done to reduce the hum until the right condenser is delivered.

In any problem dealing with condensers, remember first of all the voltage rating. Every condenser will stand just so much voltage and burn out if subjected to a greater potential. If a temporary substitute condenser of the needed voltage rating is not available, two condensers connected in series to each other may stand up where either alone would break down. But connecting condensers in series reduces their capacitance according to the formula:

$$C = \cfrac{1}{\cfrac{1}{C_1} + \cfrac{1}{C_2} + \cfrac{1}{C_3} + \cfrac{1}{C_4} + \cfrac{1}{C_5} \text{ etc.}}$$

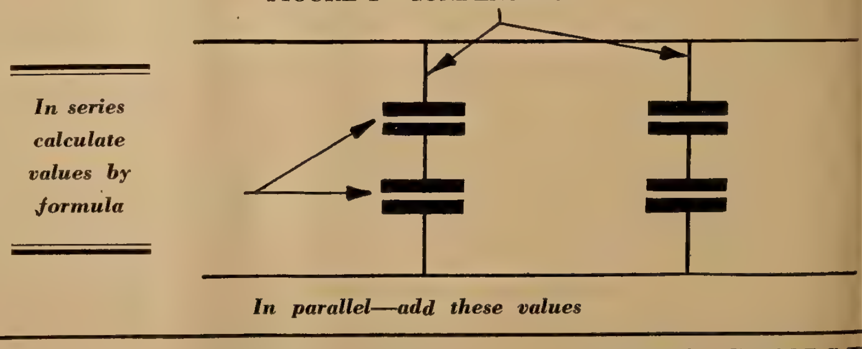
which is only the simplest kind of arithmetic, and obviously means that if condensers are to be wired in series for safety they must be *each* of larger capacitance than the capacitance required. If condensers of such capacitance are not available, connection may be made in series-parallel according to Figure 1 until the necessary capacitance is either attained or sufficiently approximated. Each of sets of condensers connected in series in that drawing has an effective capacitance which may be found by use of the above formula. Add the capacitance for the left-hand set to that for the right-hand set to find the total capacitance of the four condensers in this circuit.

Extra Condensers

Figure 1 is the simplest arrangement of this kind, and may obviously be elaborated by putting more than two condensers in series, and using more than two sets of series condensers. The arithmetic still applies in the same way.

Therefore, if a semi-permanent replacement for a filter condenser must

FIGURE 1—CONDENSERS



In parallel—add these values

be found, any amplifier or radio condensers that can be bought or found or borrowed may be connected together to form a satisfactory temporary repair, which will serve indefinitely until the correct replacement is delivered.

Very likely, of course, this temporary arrangement will not fit inside the amplifier, but will have to be placed outside and connected in circuit through leads brought out for the purpose. This is undesirable, naturally, but preferable to a strong hum in the sound.

Other condensers used in amplifiers, although less subject to complete breakdown, occasionally become noisy, producing crackling or raspy "static". In almost all cases such condensers can safely be replaced (on a semi-permanent basis) without too much regard for matching the exact capacitance or voltage rating of the original. Different capacitance of a coupling condenser may change the frequency response of the amplifier, but that is certainly preferable to "static". In short, don't let the noise continue for a long time because you can't get the exact replacement needed without delay. Approximate its characteristics as nearly as possible from among condensers that are available, in the spare parts box or perhaps in the stock of the local radio dealer—and if the new condenser won't fit in exactly the same spot as in the amplifier, wire it in as near to that location as you possibly can get it.

Loud Speaker Unit

What about that faulty loudspeaker unit, and the section of seats with correspondingly weak sound?

Well, there is no perfect substitute for standard theatre loudspeaker equipment, which is about the loudspeaker apparatus made, but sound of poorer quality that is audible certainly must be preferred to sound of better quality which can't be heard. The writer in a special case some years ago "got away with" a mere radio speaker of large size, borrowed from a powerful console-type radio, and fitted with a public address trumpet. No, it didn't do as good a job as the regular unit—but no one asked for a refund because he couldn't hear the show.

Any powerful radio or public address speaker, of first-class quality, may be connected in place of either a low or high-frequency unit. It probably won't fit the existing baffle or trumpet—it may fit the low frequency baffle, but more likely a public address trumpet will be needed. If none is available use a flat baffle-hole of proper size sawed into a piece of heavy wood or fiber board measuring several feet in each direction. Take some pains with pointing the speaker to get good overall sound distribution.

Complications of wiring will be saved if the emergency speaker is either of the permanent magnet type, or of the a.c. type that mounts its own rectifier. The first needs no power supply, and the second is powered by plugging it into the nearest a.c. outlet. The emergency speaker should offer the correct input impedance to the speech line or be connected through a loudspeaker transformer that does, and that can handle the wattage involved. But again, some sound is better than none, and it is not necessary to go into abject slavery to the idea of matching impedances. A fairly substantial mismatch can be tolerated in a pinch. (The voice coil impedance can be found with sufficient accuracy by reading the coil's d.c. resistance with an ohmmeter, and multiplying the result by $1\frac{1}{2}$).

One thing the emergency speaker must do, and that is handle the wattage imposed without burning out. The mere size of a speaker is a poor guide to the wattage it will take. Try to obtain an exact rating, even if only in terms of the output tubes and circuit (Class A or Class B amplification) for which it is recommended. The latter information, and a tube book or tube chart, will offer sufficient guidance in an emergency. The local radio man will always have the tube data.

Don't be misled by the existence of high frequency or tweeter units designed for use in a radio cabinet. They may put out enough h.f. for a living room, but substantial wattage is needed in a theatre. The sound of such tweeters will simply be lost in even a modest auditorium.

Resistors

Resistors may be treated much the same way as condensers. Consider wattage first. Make sure the resistor used can stand the current flowing through it. If none such is available, use two or more resistors in parallel, thus dividing the current. Condensers must withstand *voltage*, and it was suggested that if units of the right rating are not available, underrate units be wired in series. Resistors must withstand *current*, hence underrate units are combined in parallel.

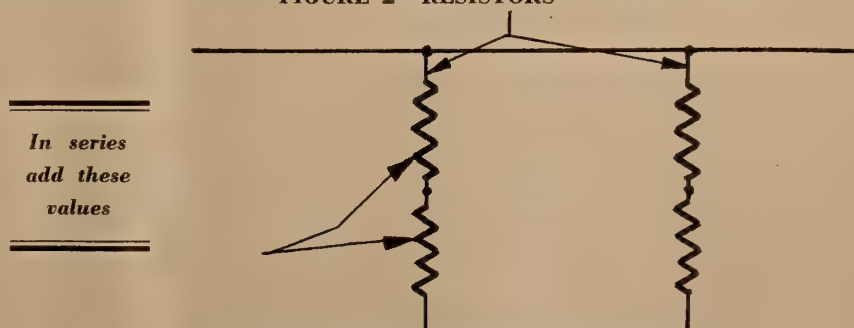
Resistances connected in parallel are calculated in exactly the same way as capacitances connected in series—by the formula given above. Capacitances connected in parallel are simply added; resistances connected in series are simply added. See Figure 2.

Resistors, like condensers, need not always be of exactly the same rating as the faulty unit they are to replace. In some places an exact duplication of values is very important. In others, a difference of a hundred thousand ohms means next to nothing. Again, the projectionist must study his circuit and determine in each case whether it is allowable to use merely an approximate value. A little distortion is better in an emergency than no sound at all, but a little difference in resistance at the wrong place can cause a burnout, or serious distortion. A resistor that provides grid bias or helps provide it should be matched very closely. A coupling resistor may vary to a considerable degree from the rated value, without any serious harm.

Considerable substitution in tubes of the radio type is entirely possible. Many tubes of more recent design are made in different models to fit different sockets, but are absolutely identical electrically. They may have entirely different numbers, however. Hence, if the projectionist urgently needs a certain tube of radio type and can't get one of that number he should look into a tube book or chart, or otherwise inquire, whether some other tube that is available is not exactly the same tube, but with a metal case instead of a glass case, or designed for a different socket. If the latter proves to be the fact, don't leave the theatre dark, change the socket in the amplifier. A metal tube can always be substituted for a glass tube if they are electrically identical—the metal case is not the plate of the tube, merely a shield which is normally connected to ground. If a glass tube is substituted for a metal tube, it may or may not be necessary to add (and

(*Continued on page* 21)

FIGURE 2—RESISTORS



In parallel—calculate these values by formula

Advancement of Sound Pictures Grows As Engineers Improve Technique†

BY NATHAN LEVINSON
WARNER BROS. PICTURES, INC.

It Is a Far Cry From the Clumsy Records to Modern Sound on Film—Many Difficulties Overcome by Technicians—Rapid Strides Being Made

THE sound motion picture has not yet attained such an age that many persons will have completely forgotten the thrill which they experienced at their first viewing of a talking picture. Yet in that brief span of approximately a dozen years since the *Jazz Singer* took the country by storm, the technic of recording sound for motion pictures, and the equipment and film stocks employed in the process, have enjoyed an uninterrupted and almost unbelievable degree of development. The practice of making duplicate or triplicate sound records of a scene to insure a single satisfactory finished record has long since been discontinued, and the type of action portrayed on the screen is today in no way limited in scope by restrictions imposed by the recording equipment.

The sound records of the earlier talking pictures were 16-inch disk records, similar in general appearance and composition to ordinary phonograph records. They were recorded at a rotational speed of 33 1/3 rpm, to permit a playing time equal in length to the time required for projection of a complete reel of picture. The recording channel proper consisted of several condenser microphones and their associated amplifiers, a mixer table, booster and main recording amplifiers, and a number of bridging amplifiers whose input circuits were multiplied across a "bridging bus" formed at the output of the main recording amplifier. The output circuit of each bridging amplifier was connected to the cutting head of a wax recording machine through a calibrated attenuator.

The cutting heads employed in the production of Vitaphone records exhibited a frequency-response characteristic which, for a constant input level, produced a record of constant amplitude for all frequencies in the interval between 40 and 400 cps, and a record of constant velocity in the interval between 400 and 5000 cps. The low-frequency response of the cutter was reduced to avoid overloading of the record by the high-energy, low-frequency components normally present in speech and music. The cutter showed a very rapid decrease in response at frequencies above 5000 cps.

The original records were cut on soft wax blanks whose surface had been brought to a high degree of polish by the use of sapphire shaving knives. The production of a good record required the use of a freshly shaven wax blank whose temperature was held within rather narrow limits to prevent smearing or chipping of the wax during recording. The novelty and uncertainty injected in the production of motion pictures by the advent of sound made it necessary to provide means for the director of a picture to check the character of the sound record immediately upon completion of the shooting of each scene. Therefore playback reproducers were provided which permitted reproduction of the record cut in the soft wax. Records which has been so reproduced were, of course, unsuitable for later processing, and for this reason it was necessary to cut two or three records of each scene photographed.

At the completion of shooting and editing of a picture it was necessary to combine the individual recordings of each scene which appeared in the finished picture in such a manner that the single record associated with each reel of the picture would contain just that dialog, music, and sound effects necessary for the scenes appearing in that reel. The process of combining a number of original recordings of dialog, music, and sound effects into a single final record is known as "dubbing," or "re-recording." The difficulty of selecting a few words or sentences from a number of individual disk records and combining these in proper order and in exact synchronism with the action taking place on the screen presented no small problem. In fact, the difficulties of this process of selection and combination were so great that only one of the Hollywood studios, Warner Bros., was ever equipped to re-record from disk records on a large scale.

Nor were the troubles encountered in disk recording ended when the final records for a picture had been completed. The maintenance of synchronism between picture and sound in the theatre was dependent upon accurately placing the theatre reproducer at the start mark on the record and simultaneously placing the picture start mark in the picture gate of the projector. If the picture film was torn during projection and had to be spliced, it was necessary to remove one or more frames of the picture from the reel and consequently at each splice in a reel, synchronism between picture and sound was destroyed by an increasing amount. Since the picture and sound record were separate, it was not an unusual occurrence to find the record corresponding to one reel of a picture being reproduced with a different reel of that picture. While this may have tended to create audience diversion during the screening of a dull picture, it helped in no way to maintain the dignity of the theatre management. Furthermore, after a certain number of playings the records exhibited a very pronounced loss of quality and often became extremely noisy. All these factors tended to detract materially from the technical and entertainment values of a picture and were responsible in no small measure for the change from disk recording to sound-on-film recording.

Recording on Film

The recording channel employed for producing the early film sound-track was practically identical to that employed for reproducing disk records. The signal output of the bridging amplifiers was merely delivered to the film-recording machine instead of to the wax cutting head. While differing in many details, all film-recording machines provide a light-tight housing in which the film is exposed, magazines for the unexposed and exposed stock, means for moving the film at a uniform speed past a light-beam which exposes the film, in accordance with the wave-form to be recorded, the light-source, modulator unit, and the optical system.

The sound-track produced on film varies in width from 76 to approximately 100 mils and occupies a position adjacent to one set of the film sprocket-holes. All track may be broadly classified as being of either the variable-density type or variable-area type and each possesses certain advantages and disadvantages not

†J. Soc. Mot. Pict. Eng.

possessed by the other. Two methods of producing variable-density track were employed during the early period of film recording. In the first, typified by the Aeo-light recording at one time extensively employed by the Fox Studios, the signal to be recorded modulated the light produced by a gaseous discharge tube and the resultant variable-intensity illumination was photographed on the uniformly moving film in the recording machine after being passed through a very narrow fixed slit. The second and more widely used method of producing variable-density track involves modulating a beam of constant intensity light by means of a light-valve and photographing the illuminated variable-width slit formed by the light-valve ribbons on the moving film. This type of record subjects each point on the sound-track to an exposure of constant intensity, but of a duration determined by the character of the signal being recorded.

Variable-area track is produced by permitting the light from a constant-intensity source to strike the mirror of a galvanometer, and after reflection therefrom, to pass through a narrow slit of fixed width, through a suitable optical system and then upon the sound-track being exposed. Oscillations of the galvanometer mirror, which are produced by signal currents corresponding to the sound to be recorded, cause the light-beam striking the recording slit to illuminate a greater or lesser length of that slit. The sound-track produced by this process of recording is essentially an oscillographic trace of the signal currents.

Although the average early sound-on-film records were little, if any, better from a quality standpoint than the disk records which they replaced, they so facilitated the production, editing, and projection of sound pictures that by 1931 practically all sound recording was being done on film. Editing the sound record of the finished picture was tremendously simplified, since the process of intercutting various sound-track sequences presented no greater problems than intercutting the corresponding picture sequences. This, of course, resulted in enormously simplifying the process of re-recording. It was now only necessary to provide reels of properly intercut dialog and properly intercut reels of music and sound effects and to re-record these in synchronism with the picture to provide a single reel of final negative. Film recording provided other advantages, however, which were scarcely less valuable than the improvement possible in re-recording methods. Unlike the requirements in wax recording where many precautions were necessary, the film-recording machine could be placed at a considerable angle and be used through a wide range of temperature with no change in quality of the finished record. The light-valves or galvanometers, once properly adjusted, are comparatively rugged devices and require much less frequent inspection and maintenance than wax cutting heads. Perhaps the only single outstanding advantage of wax over film records lies in the fact that the wax record may be immediately played back for checking purposes. whereas some interval of time must elapse between the recording process and the time at which completely processed prints from the film record are available.

The introduction of acetate disk recording early in 1934 effectively supplemented film recording by providing playback records of much greater useful life than soft wax records and having the further advantage of possessing more desirable physical properties than wax. Continuous improvements in acetate disk coating, as well as improved designs of cutting heads and reproducers now make it possible to produce acetate recordings which are almost equal to high-quality film recordings.

Playback records are no longer employed for checking the recording of individual scenes of a picture, but find their greatest application for reproduction, on the set, of music which has been pre-recorded for certain scenes of a picture. The process of pre-recording is employed primarily as a means of saving time on the set for such scenes of a picture which involve the photography of action which must be accurately synchronized with the musical score. For example, during the production of elaborate musical numbers involving complicated dance routines, straightforward production technic would demand that the director of the picture divide his attention between the action proper, the performance of the orchestra employed. and the degree of synchronism maintained by the various groups involved in the complete scene being photographed. A flawless performance on the part of the actors could be rendered worthless by a slight error on the part of some member of the orchestra, while a perfectly performed musical score might be rendered valueless by imperfect synchronism of action on the part of the principals appearing in the scene. It is obvious that the difficulty involved in securing a completely satisfactory record of such a scene is greatly increased by the number of the performing groups. The process of pre-recording the musical score for such scenes in a picture and reproducing these records on the set while the action is being photographed relieves the director of all concern regarding the orchestral performance, and permits both the director and the principals involved to concentrate their attention on securing a perfect performance. Since the record may be reproduced a number of times with the same results, the scene may be reenacted until a perfect performance is secured. The motors employed for driving the playback reproducer and the camera on the set are electrically interlocked, so absolute synchronism between the photographic and sound records is assured.

High-Fidelity

During the early period of film recording, the quality of the records produced was very much inferior to that of present-day sound-track, and it is interesting to consider in some detail the numerous improvements in recording equipment, technic, and materials which have made possible the present type of high-fidelity recording.

The variable-density type of record is essentially a halftone photograph of the recorded sound-wave. It will be evident, therefore, that undistorted reproduction of a variable-density record can be obtained only when the entire range of exposure is restricted to the straight-line portion of the H&D characteristic of the film employed, and when the overall gamma of the print sound-track, as appreciated by the phototube in the sound-reproducing mechanism, is equal to unity. Although the science of sensitometry was well developed long before the advent of the sound picture, little use had been made of it in the processing of motion picture films, and the sudden demand made upon the laboratory for proper processing of sound-track necessitated an overnight revision of processing control methods. While it was possible for an experienced person to judge the quality of a picture negative by inspection with sufficient accuracy for practical purposes, this method was wholly inadequate for the determination of proper sound-track processing, and have to give way to accurate sensitometric control of both negative and print development. The introduction of the Eastman type II*b* sensitometer in 1931 was of great value in the study of sound-track processing, since it provided a means of accurately and consistently impressing a series of known exposures on the film whose characteristics were under investigation. So powerful a tool did sensitometric control provide that within a few years after its introduction for sound-track purposes, it was almost exclusively employed for the control of both sound-track and picture processing in the laboratory. As a result of this step, the degree of uniformity and general print quality prevailing throughout

(Continued on page 22)

Maintain Projection Room Cleanliness

BY HARRY GRANT

Proper Cleaning With Correct Agents Will Prolong Life of Mechanism—Moving Parts Will Require Constant Care to Prolong Efficiency

UNDER current conditions of difficulty of obtaining supplies, it is clearly necessary to take better care of equipment on hand, and one factor in good maintenance is cleanliness. Dirt, rust and corrosion cause various kinds of damage. In the past, when parts were easier to obtain, cleanliness was often thought more expensive than somewhat premature replacement. Present conditions, which may involve an indefinite delay before a replacement can be shipped, naturally call for much greater care in preventing any breakdown in existing equipment, even in spite of the fact that the time spent cleaning some part or component may be worth more than the part itself.

A further complication in today's very complicated picture is that some cleaning materials are becoming scarce and will be scarcer, thus forcing the projectionist to learn — or sometimes even to invent—new techniques for taking care of his apparatus. This is only one way among many ways in which today's equipment situation increases the responsibilities of the projectionist. It is one that has been to some degree overlooked because past policies quite generally favored reasonable replacement as more practical than over-zealous maintenance.

Yet even the mere mechanical injury that dirt can do in gears, bearings and other moving parts needs no elaboration. Any gritty material in closely-fitting moving parts naturally will increase wear. The effect of dirt on electrical equipment is less obvious but often more serious. In volume controls, for example, and similar variable contacts, a very light film of dust may cause extremely minute sparking which tends to produce some surface corrosion or other deterioration of contact, progressive in nature. Many theatre volume controls, particularly in modern sound equipment, are rather inexpensive, and replacing them has been cheaper than paying them too much attention. If replacements can't be had, that's another matter.

Oil in the wrong place is a form of dirt which may be very injurious to electrical insulation. Corrosion of any kind is an obvious danger, the surface evidence of which may be hidden from inspection by an overlying layer of dust.

Every projectionist knows what will happen to a commutator that is allowed to remain dirty. Dirt in the projector will have the effect of scratching or scoring the guide plates and shoes and cause pad rollers to stick.

Minimize Dirt

A first and most obvious precaution against dirt is to minimize its presence in the projection room. A common source which is particularly bad for electrical equipment is the carbon arc. The lamphouses should be vented to some place outside the projection room. Where arrangements for this do not exist they should be installed at once, while it is still possible to do so. A cause for grit that is exceptionally hard on mechanical parts is a cement floor. Impalpable scraps of cement are rubbed off and thrown into the air of the projection room with every footstep. Such floors should be painted, or covered with linoleum.

Special precautions are needed in theatres where the projection room has windows opening out-of-doors if the location is either dusty or smoky, and in manufacturing communities where the air contains harmful fumes. Such projection rooms may be connected with the air conditioning system or fitted with window ventilators of the type that clean the incoming air—but whatever is done should be done promptly, while there is still time.

The porter should not be permitted to dry-sweep the projection room floor, especially not with a stiff broom. Sprinkling before sweeping, and use of a soft type of broom, involve no particular trouble or delay and keep dust out of the air.

Cleaning the apparatus, after every precaution has been taken to avoid needless accumulation of dust, is a complex matter because projection room equipment is so varied. Some parts, particularly in the projector, soundhead, motor bearings and so on, are not cleaned. They are washed by the lubricant. It is obviously necessary to use only the purest lubricant, and to keep it clean while in the projection room by keeping containers well covered. Under today's conditions old lubricant should be flushed out and replaced more frequently.

Old lubricant, especially if partly hardened, does not always flush out readily. The same oil or grease, heated, will help remove it. Solvents also may be used instead, but they present a problem in themselves these days, which is discussed further on in this article.

All parts should be watched more carefully, particularly for signs of overheating, which may be caused by clogging of the lubricant, either because it is too old or because it has become dirty.

Accumulated dust and dirt is commonly blown out of amplifiers and other sound equipment with a small hand bellows. This step is necessary and desirable, but it is also desirable to have a strong draft in the projection room, if possible, when such cleaning is done, to assure that the major part of the dust removed by the bellows is drawn out of the room, and does not circulate in the air to settle somewhere else.

It is as well, also, to try to have some draft present when sandpapering a commutator, to get the microscopic particles of sand and copper out of the room. Cleaning the commutator is a different matter, again involving the use of solvents or some form of cleaning compound.

Cleaning Compound

The commonest cleaning fluid in projection room practice is carbon tetrachloride. Many projectionists take it from the fire extinguisher, meaning to reload the extinguisher later. They may now find delays in the shipment of replenishments for the fire extinguisher, so that that practice, always dangerous, is today a little more nearly suicidal than in the past. Leave the contents of the fire extinguisher alone until you need them to put out a fire. Otherwise you'll take a little, and the other shift will take a little, and a new supply may be delayed, and—well, leave the fire extinguisher alone. Lay in a supply of carbon tet or use something else. There are other solvents.

Carbon tetrachloride has all three advantages desirable in projection room cleaning. No substitute has all of them. (1) It is a good solvent for oil and grease. (2) It evaporates completely, leaving no residue. (3) It is chemically inert, and therefore will not promote corrosion and will not burn.

There are many other good solvents for grease. Some evaporate quickly and completely. But there are none commonly available that equal carbon tet in the third point of chemical inertness. The cost of a material used for cleaning must also be considered, and so must physiological effects—ether, for instance, has advantages for some purposes but is not good stuff to breathe. The commonest and cheapest solvent for grease, of course, is soap and water, but not too desirable for projection room equipment.

Carbon tetrachloride is found in the common household cleaner called Carbona. Although the exact composition is a trade secret, the material is commonly believed to consist of a mixture of carbon tetrachloride and benzene, the latter added because it is cheaper, but kept down to a proportion that still leaves the liquid non-inflammable.

Alcohol is good solvent for most grease, and evaporates quickly, but of course does catch fire. Commercial rubbing alcohol and the like usually contain considerable water, which is undesirable and slows down the evaporation. Pure or "absolute" wood alcohol can be had in any drug store. Gasoline also may be used as a cleaning compound.

Wherever substitutes for carbon tetrochloride must be employed the projectionist should remember very scrupulously that carbon tet is not inflammable but the substitute probably is, and avoid established habits such as smoking, using the material where it may be exposed to a spark before it has completely evaporated, carelessness about handling containers in the vicinity of flame, etc. Habits built up through years of using a perfectly safe, non-inflammable cleaner may prove dangerous traps unless constantly watched.

Avoid Soap and Water

Soap and water should be avoided. If used, remember that unless the soap is thoroughly flushed away it may leave a damp, sticky film behind, to collect more dirt, or perhaps promote corrosion or even a short circuit. The theatre porter very likely has some "soapless" cleaning compound. This will probably be tri-sodium phosphate or closely related chemical. Used in water, it will not leave a soapy film, but may deposit undesirable, gritty crystals of more or less microscopic dimensions. Neither crystalline nor soap cleaners evaporate at all. Only the water does, and great excess of water must be employed to make certain that all of such cleaning material has been thoroughly flushed away. Whereas with carbon tet, alcohol and the like, all of the cleaner evaporates, leaving nothing behind.

The projectionist will very likely have to use some judgment as he finds this or that cleaning compound temporarily hard to obtain.

Electrical contacts should be cleaned, more frequently than in the past, with a clean cloth moistened in a suitable solvent. This applies to all exposed volume control and rheostat windings. A single thickness of cloth should also be passed under the contact slider, using a thin cloth and taking care not to weaken the slider's spring tension.

Tubes should be removed from their sockets occasionally, and their prongs cleaned in the same way. This also should be done more frequently than in the past. It is less necessary in the case of the newest types of socket, but of considerable importance with early models of sound equipment. Switch prongs and contacts associated with sound circuits should be similarly treated.

Watch the Lenses

Do not use any kind of solvent for cleaning compound lenses, whether projection or sound. The compound lenses are cemented together with Canada balsam. Some of the solvent may be drawn into the cement by the capillary attraction of the glass surface. If the cement becomes loosened, even slightly, the lens will be imperfect and have to go back to the maker for repairs. The factory is likely to be very busy with range-finding lenses and the like, and to keep you waiting. Use clean, *dry* lens tissue.

Be careful with both emery cloth and sand paper. Emery (carborundum) is of course a conductor, and the fine particles may set up short-circuits. Emery is never used on a commutator, for example. The fine particles of sandpaper, although not conductors, are highly abrasive. Avoid the use of sandpaper where fragments of the sand surface can by any chance drift or be blown into the projector or the soundhead.

Corrosion may be the result of dampness, improper soldering, or carelessness with dry cells or batteries, to name three common causes. Probably the only practical protection against dampness is to close the projection room thoroughly overnight. Improper soldering in the past will have to be left to do its evil work until some evidence of corrosion turns up. One excellent warning is the appearance of the connection, which again means keeping everything sufficiently clean and free of dust so that visual inspection will show when stranded wire is beginning to fray at a soldered joint or contacts begin to discolor. Improper soldering in this case means use of the wrong flux. A strongly acid flux makes soldering easier. It attacks the oxide coating of the metals that prevents their forming a bond with the solder, dissolving this coating and permitting the bond to form. This needless ease in soldering is paid for in future trouble. Rosin is a perfectly safe flux, and rosin-core solders are available for convenience. The bond is not formed quite so readily, the parts must be more thoroughly heated, but the chance of subsequent corrosion is greatly reduced.

Dry Cells

All "dry" cells and batteries contain a wet, corrosive paste. Recently, to prolong the life of such cells, manufacturers have added moisture-retaining chemicals. The corrosive paste has a tendency to eat pin-holes through the zinc container, after which it oozes out, and corrodes almost anything with which it comes in contact. The fact that the cell or battery is not used very much affords little protection to the zinc. The zinc may be eaten through which the cell is standing on the shelf, not used at all. Inspect any apparatus that contains such cells or batteries very frequently. A few days' neglect may give the paste time enough to eat through the last few layers of zinc and seriously corrode the surrounding equipment. Don't delay inspection until after replacement cells have arrived. The corrosive paste can be washed off with a water-moistened rag. Wash away every trace of it. If it contains the new moisture-retaining ingredients don't expect it *ever* to become harmless by drying up.

Rust is best treated by sandpapering and repainting to protect the exposed surface. Chemical rust-removers are on the market, and advantageous in some cases, particularly where sandpaper should not be used, as on castings associated with close-fitting moving parts.

FEMME PROJECTIONIST

Pahokee, Fla.—Well, fellers, it has come. The Prince theatre here has placed Geraldine Henderson as a projectionist, who replaces her brother, Brown, who has joined the Army. Geraldine served her apprenticeship under her brother and shows great promise.

Better get used to it men, for you're going to see a lot of such replacements before the war is over.

Hints On 16mm Sound Projection For Defense Film Shows†

BY ART LLOYD, A.C.S.

Small Projector Will Have Top Spot in Army and Navy—New Machines Are Designed to Give Maximum Performance Under Adverse Conditions—Takes Its Place in Defense.

AS individual amateurs and clubs all over the country volunteer to help the War Effort by showing 16mm. Defense Films, the question of projection takes on a new importance. Even though they're on 16mm. film, and possibly projected by amateur projectionists, these pictures have a man-sized job to do. They've an urgently important message to bring to their audiences, and any amateurishness in the way they're projected will weaken the effect of that message proportionately.

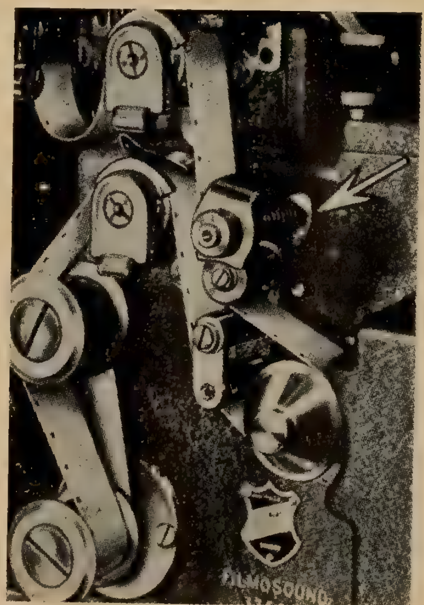
Most, if not all, of these Defense Films are going to be 16mm. sound-films. And while most amateurs serious enough to volunteer for this sort of work may be presumed to be pretty good projectionists as far as silent 16mm. and 8mm. films are concerned, sound-on-film is likely to be new territory to many of them who have never before had reason to operate a sound projector.

Luckily, operating a modern 16mm. sound-film projector isn't half as intricate as it might seem on first inspection. Even though the sound part of the outfit may be new and unfamiliar, the picture part should be an old friend. The picture-projecting section of any 16mm. sound-film projector is almost always virtually identical with—or at least very similar to — the same manufacturer's more familiar silent projectors. It is threaded, operated and cared for in the same way you'd handle a silent projector.

The sound synchronized with any individual picture frame is printed on the edge of the film some 25 frames ahead of the picture. That is, below the picture-aperture when you're threading the machine. As far as the lower driving-sprocket, the machine is usually threaded just as you would thread any silent projector. Then the film makes a fairly taut loop around the sound-drum where the sound pick-up is made. From there it passes, in most designs, over a third driving-sprocket which isn't usually found in silent projectors, and from thence—often over various idling rollers—to the take-up reel.

Now one of the most important factors in getting good sound is making sure that the film moves really smoothly at the point where the sound pick-up is made. That's why in most designs the sound-scanning drum is either attached to a fairly heavy flywheel, or is heavy enough in itself to act as a flywheel. The drum is not driven by the projector's mechanism, but is revolved by the film passing over it; therefore it resists any uneven movement in the film, and tends to keep the film moving smoothly. For this reason, while the film's loop around the sound-drum mustn't be such a tight fit it would tear the sprockets, it also shouldn't be too loose.

But this alone isn't always enough to iron out the minor irregularities of motion given to the film by the teeth of the driving sprockets above and below the sound-aperture as they engage and leave the perforations. For this reason, most designs provide some additional mechanism intended to smooth the film's travel to the last touch of perfection.



Sound projectors differ from silent ones only from the take-up sprocket down. Arrow points to the stabilizer and smooths film motion over sound scanning drum. Beyond is the sound driving sprocket from which film passes to take-up reel.

Sometimes this mechanism may be rather intricate and hard to thread, like the somewhat perplexing system of rollers in the Eastman Sound Kodascope Special, through which the film must thread a snake-like path. Sometimes it is a comparatively simple system of idling rollers, like the "oscillatory stabilizer" on recent Bell & Howell Filmsounds, in which if the film-loop slacks up on one side of the sound-aperture, the stabilizer oscillates and automatically tightens on the other side of the loop.

Most 16mm. sound projectors have instructions—complete with a threading diagram — prominently printed inside their blimps or carrying-cases. A few minutes spent reading these instructions, and studying the diagram before you try to thread the machine will save you plenty of trouble and maybe broken film during the show!

Most of the manufacturers, too, have simplified the wiring connections so that their machines can hardly be connected any way but the right one. In most 16mm. sound projectors, you'll find that current has to be supplied to two separate places — the projector-mechanism itself, and the sound system and its amplifier. In some designs, these two power-feed cables are entirely separate. In others, like the Bell & Howell models, a special cable is used, which plugs into the power-supply outlet as a single line, and at the other end divides into two lines, one for the projector and the other for the amplifier. Usually, it is unimportant which of these leads goes into which unit, as both are designed to operate on current of the same voltage and frequency. But be sure *both* lines are plugged in if you want to run sound!

In some projectors, the amplifier is built directly into the base or the blimp-case of the projector, and sound pick-up and amplifier are permanently connected. In other designs, the amplifier is a separate unit, and must be connected to the projector by a short cable.

In all projectors, naturally, the loudspeaker (or speakers) is separate from the projector and amplifier, as it has to be placed "down front" by the screen. There's a special cable for this, too, usually 50 feet or more in length.

In most designs, it is impossible to connect the sound wiring wrongly: the line from the projection-head to the amplifier is fitted with one type of terminals, and that from the amplifier to the speaker has a very different type. These are usually of the six-wire variety, and in both cases, they're designed so that

† American Cinematographer.

they can only be plugged in the right way, so that the right wires connect to the right terminals. As in a radio-tube mounting, one of the prongs is just slightly larger than the others, and won't fit into any connection except the proper one, which brings all the lines into their correct relationship.

Many of the larger 16mm. sound-film outfits are equipped with amplifiers made to handle two projectors. In such equipments, you'll find a clearly-marked place to plug in projector No. 1, and a similar place to plug in Projector No. 2, and a switch on the amplifier's control-panel that permits changing over from one projector to the other without any break in the sound. Many of them have, too, suitable inputs and controls so that you can use the system's amplifier and speakers with a microphone, as a Public Address system, or with a phonograph turntable. In some, you can "mix" film-sound, discs and microphone.

Projector Controls

The controls of a sound-film projector shouldn't be any mystery to anyone who has a modern radio. You'll find an "off-and-on" main switch, a volume control, and one—sometimes two—tone controls. Use them just as you'd use the corresponding controls on your radio. In some designs, you'll find the tone-control marked with indications such as "voice" and "music." These obviously indicate the settings at which voice and music reproduce to the best general effect: the "voice" setting means that the tone is set fairly high, with the bass suppressed, as that setting gives the highest intelligibility. The "music" setting usually means that the bass is accentuated, since most people prefer their recorded music with plenty of "oomph." If possible, it's a good idea to run all or part of your picture through beforehand, as a rehearsal, so you can find what settings give the best results from a given film on a given machine. Don't be afraid to change your tone-control setting during the show, using the high or "voice" setting for dialog or narrated sequences, and the "music" or low setting for sequences which are silent with only, or largely, musical accompaniment. You'd better rehearse for your volume setting, if possible, too, since it is very difficult to judge volume accurately when you're right on top of the projector. Try and gauge your volume for the middle of your auditorium. Remember, by the way, that you'll need a bit more volume when the auditorium is full than when it's empty, as people's bodies absorb quite a bit of sound. If you can't rehearse, keep the volume setting just a bit below the one that sounds best to you when you're close to the projector.

On some of the best 16mm. sound-film machines you'll find an additional setting on the sound-scanning optical system of the projector itself. Sometimes this is labelled "Fidelity." Sometimes it isn't labelled, but you can spot it as a little lever on the lens of the sound-scanner, or (as in the Eastman Sound Special) as a little sliding button nearby. This setting changes the focus of the sound-pickup beam, to compensate for the position of the emulsion, as it may be toward or away from the lens. This is very important if you want to get the best quality out of your sound; an out-of-focus sound-pickup will give poor-quality music, and makes voices sound "fuzzy." Try your film with the sound-focus in both positions, and you can very easily hear which gives the best results with that particular print.

Setting up the sound-projector doesn't differ materially from setting up for silent projection. The projector should be back of your audience if possible, and a bit above their heads. It should be on a pretty rigid foundation, too. The screen should be well centered with the projector, with its bottom edge at least four and a half feet from the floor. If you have any chance of suiting the size of your screen to the size of auditorium and audience, it's a good, general rule to try to have the screen large enough so that when you stand in the middle of the auditorium and hold your clenched fist in front of you at arm's length, the screen, as you look at it with one eye, seems not quite twice the width of the first. In any event, don't try to use a screen larger than your projector will illuminate satisfactorily *with the particular film you're going to run.*

Placing Loudspeakers

While it's generally handier to place your loudspeaker or loudspeakers on the floor beside the screen, you'll get the best results if you can place the speaker above the screen—over the heads of the audience—with the axis of the speaker's cone aimed downward at about the center of the auditorium.

Most serious amateurs have already learned the value of turning the projector's mechanism a turn or two by hand, to make sure the film is feeding through properly. This is doubly important with a sound-projector. It's a good idea, after you've done this, to flip the motor-switch on for a second, as well, to make sure everything's all right. Some machines, like the Sound Kodascope Special, have a little button you can press to do this. If your film is a reduction from a 35mm. original, it's quite likely to have the "Academy standard" leader on it, which gives you several feet of leader-film with which to make sure your projector is properly threaded.

In starting a silent projector, many amateurs make it a practice to flip the motor-switch first, and then turn on the projection-lamp. This is just as good an idea in projecting sound. However, remember that your amplifier gets its results with tubes just like those in a radio, and these tubes usually take a minute or so to warm up. So be sure and switch on your amplifier several minutes before you're ready to start projecting. If you don't, your show will begin embarrassingly silent—and suddenly the sound will come booming out unexpectedly!

Spare Bulbs

If you've had any experience projecting silent films before audiences, you've probably learned (from sad experience!) that it's always a good policy to come provided with a spare lamp bulb, just in case the one you're using burns out. This holds true for sound-projection, too; in fact, if you're going to be giving Defense Film shows in strange auditoriums, it isn't a bad idea at all to come equipped with a variety of lamp-bulbs, so that you suit your illumination to the needs of the situation, using a low-powered globe in a small room, where you can get only a small picture, and a higher-powered globe—or even a "10-hour" one—where you've got to throw an extra-big picture or use a poorly surfaced screen.

In addition, don't forget the sound mechanism depends on several types of globes which can burn out, too. If you can, have some spare tubes. But at any event, supply yourself with a spare exciter-lamp. This is the tiny bulb which casts a little pencil of light across the sound-track and enables the photocell to pick up the sound. It is also one of the shortest-lived components of a sound projector. A spare exciter-lamp is a "must" if you're planning serious showings! A spare photocell is another useful thing to tuck away in your kit. You don't often need one—but when you do, well, your sound is dead until there's a "live" photocell in its place in the machine!

Finally, remember the points which make *any* show—silent or sound—more professional. Get your outfit set up, threaded, and completely ready to go *before* your audience arrives, if you can possibly do it. If you've more than one reel to show, use two projectors if possible, so you can change over in professional style, and keep the show going without a break. And always save your rewinding until after the show's completely over!

Priority Restrictions Calls For Operators' Ingenuity

BY HARRY RUBIN

DIRECTOR OF PROJECTION, PARAMOUNT THEATRES

COPPER — tin — bronze — brass — aluminum — high-speed tool steel— rubber — hardly a day passes without further governmental restrictions being placed on the use of these strategic materials for industrial uses. More and more of these materials will be required for war purposes. This means that theatres will be obliged to get along on whatever amounts of these materials that can be spared without impairing the war effort, or, alternatively, on substitutes to be made of inferior materials.

It is not difficult, therefore, to realize that the present conditions under which the theatres must operate demand that the longest period of satisfactory service be exacted from each and every part of its equipment.

Intelligent care can result in projector parts giving from five to ten times the service they would otherwise give if neglected!

You, the projectionist, have a splendid opportunity to render a valuable service to your government, your theatre, your patrons and, not the least important, to yourself. This will be a patriotic service since you will be helping industry to carry on with a minimum need for the materials so urgently needed elsewhere. You can make a definite and valuable contribution to the public welfare by assuring your patrons of smooth-running shows.

Relaxation and good entertainment are even more important now than they were under peace-time conditions, since these factors are recognized as the most effective means of maintaining morale and of preventing "war nerves." Accordingly, your responsibilities, great as they have been in the past, become immeasurably greater under these new conditions.

Pointers on Economy

There are many ways in which you can effect economies and prolong the useful life of your equipment and of the film itself. A few of the many points are mentioned in the appended paragraphs:

Proper lubrication means the application of just enough of the correct grade of oil only at the various friction points and at frequent intervals, rather than a flood of oil every few days or so. The excess oil not only runs off without serving any useful purpose (outright waste!) but also does actual damage by spreading to the film. The secret of properly oiling projectors is to use an oil can which will pass only a drop at a time. This type of oil can should be used for all projector bearings. A larger can is required to lubricate the reservoir of the intermittent and other oil wells in the sound-head.

Fire valve rollers should be kept clean, and an occasional drop of oil applied to the bearings. If they are not looked after, they will not revolve. If they remain stationary, the film soon wears a flat side on them, rendering them useless and resulting in extensive scratching. Tension on the upper magazine spindle should be sufficient only to eliminate back-lash of the film. This will minimize wear on the upper or feed sprocket and on the film. All sprocket idler rollers should be adjusted to a spacing from the sprocket equal to two thicknesses of film—*no more and no less.*

Spring tension of the film gate should be adjusted to a minimum at which the film will remain steady on the screen at the standard projection speed of 90 feet per minute. This will prolong the service of the intermittent star, cam and sprocket, the film tracks, the tension pads and also the film.

Take-up tension should be adjusted to the minimum required to wind 2000 feet of film on the standard theatre reel, having a 5-inch hub, which each theatre should use exclusively. This will reduce wear on the take-up sprocket and on the film.

The daily cleaning of carbon contacts of the projection arcs will prevent the formation of a high-resistance scale that causes damage to the contacts and adjacent parts of the lamp and also results in electrical losses and an inferior light on the screen.

Vacuum tubes will give much longer service if the proper warm-up period is always allowed before connecting the tubes to the high-voltage plate circuit.

Cast aluminum reels should be handled carefully to avoid dropping or bending since replacements may be difficult to obtain.

Watch the Motors

The motor-generator should be checked to see that it is positioned horizontally to allow the armature shaft to "float" in the bearings, and also that there is sufficient end-play in the shaft to permit this action. The spring tension on each commutator brush should be adjusted to the minimum that will insure good electrical contact. The contacting surface of each brush should be examined for condition. These adjustments will hold commutator and bearing wear to a minimum.

There should be established a definite time schedule for the regular periodic examination and lubrication of projector motors and arc-feed motors.

Film should be examined after each showing and all defects remedied before it is used again. Rewinding should be done evenly and slowly to avoid scratching the film.

Carbons should be burned only within the amperage range recommended by the manufacturer. The burning rate of the trim used, and the length of the positive and negative carbons required for the various-size reels, should be accurately determined. Such data will enable the projectionist to obtain the maximum service from each package of carbons—without sacrificing to even the slightest degree the quality of screen results.

In other words, a show normally consists of single reels in addition to the quota of double reels, hence carbon stubs of appropriate length for the various-size reels can be used and carbon waste can be held to a minimum.

Adherence to the foregoing will justify your status as a craftsman, serve the needs of your fellow countrymen and give you the deep personal satisfaction of having served your country in these trying times.

RECORDS FOR BLACKOUT

Hollywood—Adoption of a standard recording for use to advise the public of blackouts during theatre performances, has been announced by the Los Angeles Theatre Bureau.

Recordings, which are available to theatres, are divided into three parts. First interrupts the program to notify the audience a blackout is in progress and asks the patrons to cooperate. Second, used at the close of a feature to inform the audience that Army regulations do not permit anyone to leave the theatre until the "all-clear" has sounded. Third tells the public the blackout is over and thanks them for their cooperation.

THEATRES FOR ARMY

Miami Beach, Fla.—The Army, which to date has leased 70 of the largest beach hotels in this city to house officers and men, is now contemplating leasing several of Miami Beach's largest theatres.

The houses under consideration are Wometco Lincoln, Cameo, Plaza, Beach, Sheridan, Cinema and Colony.

The Army is considering two plans of operation. One would utilize the theatres mornings to show training films. Second calls for training films in the afternoon and first run features at night.

Only Army personnel would be admitted to the theatres and 14 cents would be the admission price.

Civilian Defense Orders Shows To Go On Regardless Of Raids

Managers Held Responsible—Pamphlet Explains New Rules—Seek to Avoid Panic-Films or Recordings to Pacify Audience—Wardens for, Each Theatre Must Be Designated.

WASHINGTON. — The Office of Civilan Defense has advised the nation's theatres that the show must go on in an air raid to keep the audience calm, and asked the public to obey the traditional discipline of the theatre: "Walk—don't run, to the nearest exit."

In the event of a direct bomb hit on the theatre, the O. C. D. left it to the theatre's chief warden "to determine immediately whether the audience should remain in the theatre or be evacuated."

The O. C. D.'s recommendations were issued in a pamphlet entitled "suggested regulations for theatres," approved by technicians in the "air raid precautions division, War Activities Board, motion picture industry," and the O. C. D. civilian protection division.

The suggestions apply also to concert halls and other amusement places where large crowds may be gathered during a blackout or a raid.

The theatre management is declared responsible for arranging with the Citizens' Defense Corps to have the theatre designated as an air-raid warden post and provided with a staff of wardens and assistants for the orchestra, balcony and other parts. Managers are specifically instructed to have all wardens on duty in a raid.

"Continuation of the show," the pamphlet said, "will do more to keep an audience calm than anything else." If the show is stopped, records should be played over the talking-picture system, the O. C. D. added, and where there are stage shows, "it is possible to engage in community singing."

Managers are requested to announce that the show will continue, that the "audience will please remain," and that "they are safest inside the building," and that patrons should obey attendants.

Stage or house lights should be raised before any announcement is made requiring action by the audience, the instructions said.

If it is necessary to clear the house, ushers are to open specified exit doors and return to direct patrols. Next, the chief warden is to ask the audience to leave by the nearest exits "because of a disturbance in the neighborhood." Music should be played, by band, organ or recording. If a stage show is on, the evacuation should be announced by the master of ceremonies, but only if he is told to do so by the warden or assistant warden. Staff members are to set an example by manifesting calm, the O. C. D. said.

The pamphlet also stated that if an incendiary bomb lands on the theatre roof and is brought under control by fire watchers, the warden may decide that patrons would be safer if they remained.

The pamphlet outlines comprehensive plans for training theatre personnel to meet any emergency.

In London many theatres timed their last performances to end with "blackout time" each night. Motion-picture houses which kept running after the blackout flashed a sign on the screen, "Air-raid warning," as soon as the sirens wailed.

VOTE MORE WORK

Seattle—Local 15 of this city, has voted a six day week due to the shortage of men. They have been working five days, eight hours.

According to Business Agent Basil Gray, the men voted for six days, straight time, and to use the extra money for the purchase of war bonds. The Union members had already allotted three per cent of their salaries to bonds.

The shortage of projectionists is becoming acute since most of the younger men are being called to the colors.

AIR TRAINING SCHOOLS PUT IN 35MM PROJECTION

Calgary—Many more RCAF and RAF air training schools in Alberta, already supplied with 16mm equipment, have recently installed 35mm projection machines. This has occurred through the recent step-up in training courses, cutting down leisure hours of students.

Officers claim that trips to town or city should not be so frequent now that training period has been compressed to shorter period. So far little difference has been felt by nearby exhibitors.

KEE THEATRE DESTROYED

Kewanee, Ill.—The Kee theatre here has been completely destroyed by fire and the Plaza, next door, seriously damaged and is closed. Both houses were operated by Paramount.

The Plaza will reopen if it can get the materials, but the Kee was so badly damaged it would have to be completely rebuilt and with priorities that would be impossible at this time.

Warners Are Testing New Color Film To Compete With Tech

COMPETITION to Technicolor's almost virtual monopoly on feature color production in Hollywood is seen in the interest being shown by major companies in Gasparcolor, invention of Dr. Bela Gaspar. Process will permit film companies to use their own laboratories for developing and printing and otherwise cut expense usually attached to color production.

First of the majors to take actual steps toward use of the Gaspar color method is Warners, which has equipped a developing machine to handle the process in a tryout move that may lead to production of features if the system proves satisfactory on all counts. It is expected that first tryout Warners will make will be in its cartoon division, then stepping up to short subjects and eventually features.

Process is being offered to all studios by Gasparcolor, Inc., of which George Converse is president and James Roosevelt, vice-president, without licensing fees or necessity of contracts, raw stock being available to all same as black and white. Gasparcolor, a three-color process, is a single coat negative that will permit use in regular black and white cameras. Company officers assert process lends itself to color uniformity regardless of the number of prints pulled and will not fade, as color is in the film and not applied. Costs compare favorably with black and white positive stock, running about a cent and a half more, as against a Technicolor initial cost of around four and a half cents a foot.

Both 20th-Fox and Metro are understood to be interested in the process after viewing sample footage made in Gasparcolor. Warners is first major to really start actual tryout of the system, a color policy it has been pursuing for some years in an effort to hit on a method that would entail less production expense than that connected with other color processes. Gasparcolor expects to be ready within the next two or three months to offer a print service for 16mm. films shot in Kodachrome on a commercial basis, considerable work having already been done along this line by the Hollywood Color Film Company.

War-Time Booth Procedure To Save Equipment Will Be Rushed

WITHIN the next 30 days every film house in the country will receive what amounts to a procedure code based on the original 10 points outlined by Richard Walsh, president of the IATSE and MPMO.

The Atlantic Coast Section of SMPE has arranged, it was announced recently, to have its meeting on May 21 in the Hotel Pennsylvania dedicated to the discussion of "War-time Conservation in Theatre Projection," pointing out that the welfare of the country, the progress of the war effort, and the jobs of so many serving the technical side of the industry are tied in with the conservation of vital materials.

Presentation of the subject will be made by a group of members of the Projection Practice Sub-Committee, and, following the discussion, will be a paper on "The Defense Program of the Motion Picture Theatre" by Henry Anderson of Paramount Pictures' home office.

Distinguished members of the projectionists' groups have already been invited, and all projectionists and others in allied fields are urged to attend. It is impressed at this time upon the trade that conservation of peace-time materials means more war-time material.

P. A. McGuire, long associated with the idea of improving projection conditions, and strenuous advocate of the principle that "better projection pays," will be in charge of publicity for the meeting and contacts with the projection field, SMPE's headquarters here announced.

It is understood that the film trade press will serve as the disseminating agency for the amplified 10 points promulgated by IA and the Government.

Music Hall Projection Chief Has Giant Job To Perform

AMONG the last few ivory towers of our time are the motion picture projection rooms in theatres. From these cubicles, suspended high above the customers, the celluloid that dreams are made of is projected on a screen before a rapt audience which hangs on each flicker of illusion.

There are few poets, however, living in these ivory towers. There is instead a breed of practical individuals, numbering approximately 2,100 in New York City alone and organized in Motion Picture Machine Operators Union Local 306. Although they are the link between the manufacturers of glamour and the ultimate consumer, they are not particularly impressed by their commodity. To them the players are little more than combinations of light and shadow that come neatly packaged in cans.

Take, for instance, Charles Muller, chief projectionist at Radio City Music Hall. If you think that all a motion picture projectionist has to do is run reels of film through an electrically-operated machine, then you ought to inspect Muller's domain. Here, seven stories above the heads of the audience, he holds sway over a corps of fifteen men in the largest projection room of any theatre, as compact a unit of machinery as that of an air liner and as spruce a spot as Dr. Kildare's laboratory.

Before each image reaches the Music Hall's giant screen, 200 feet away, it is enlarged by Muller and his magicians to 32 by 27 feet from the celluloid frame that measures 1 by ¾ inches. To accomplish this there is a battery of four projectors, an intricate series of schedules and two shifts of projectionists.

Down-to-Earth Specialist

Muller is a down-to-earth character for so lofty a profession. "Nothing unusual ever happens here," he tells you. "All the excitement is on the screen." About the worst thing that could occur in a projection room would be for the film to snap or the machinery to break down. This has never happened at the Music Hall because of the care taken with every detail."

Muller never touches the projection machines except to break in a new picture schedule for its first few showings. Usually he supervises the department and presides over the Music Hall's plush screening room, where new and forthcoming pictures are first shown to the staff and executives. Muller also edits and prepares all film for use in background scenes for stage shows.

The way he broke into his profession would make a good scenario. It happened thirty-four years ago at the Happyland outdoor theatre in Ridgewood, L. I. Admission was 5 cents, but the neighborhood kids used to get in two for a nickel.

"The show there lasted half an hour," Muller recalls, "and at the end of each showing the manager would have to chase the youngsters out of the place. I was one of those kids.

"One day I was sitting on a bench in the last row when the projectionist was called to the telephone. In those days the projection machine stood on a wooden table and the operator turned it by hand. 'Hey, kid,' the operator called to me, 'crank the machine for a couple of minutes.' I did; and I helped the projectionist at his job every night after that. Soon I became a full-fledged operator myself."

Jarring Note Arrives

The business of running a projection machine has changed a lot since the old days. Today a projectionist has to be familiar with the complex machinery and able to make necessary adjustments of light and sound for varying conditions in a film.

Years ago projectionists like Muller worked twelve hours a day, seven days a week. Today a projectionist at the Music Hall works six hours a day, four days a week. The coming of sound introduced a slightly jarring note into the calm of the projection room, but the present-day development of machinery has made the projectionist's lot much easier on the whole.

WALSH STAYS AS IA PREXY

It has been reported that there will be no election of national officers of IA this year at the June Convention to be held in Columbus, O. It is expected that a resolution providing for two year terms for officers will be carried.

Richard Walsh, IA prexy, will continue in office for two more years, due to the fact that he was named to fill out the unexpired term of George Browne. The latter had been named for a four year term at the Louisville convention.

EASTMAN EARNINGS

Rochester, N. Y.—Eastman Kodak reports net profits of $21,588,790 for 1941. The company in addition to turning out film for the army, is making intricate instruments for anti-aircraft guns.

MUTUAL AID PACT

Picture producers have arrived at an inter-studio assistance pact in case of war damage. The mutual assistance agreement will extend to technicians as well as equipment and may even lead to the exchange of players in some instances.

Since practically all of the studios are located in Hollywood, they are more subject to bombing than most places, and they offer an excellent target. It would take no great imagination to picture a bomb hit on one of the plants. Should a studio be unfortunate enough to be hit, it would have to remain down for the duration and many exhibitors would suffer.

Through the new agreement, the lucky producers would offer all their facilities to their unfortunate neighbor. Just how the technicians and players will react to the agreement remains to be seen.

Line Voltage Problem Will Add To Projectionists' Woes

ALWAYS dangerous to projection room apparatus and operation, line voltage trouble has grown into a triple threat, and a very serious one, through the emergence of war conditions.

In the first place, theatres that never had such difficulty before may have it now, as manufacturing plants are expanded and new ones appear where they never existed before. Further, in supplying power for new needs, utilities are interlinking their lines beyond previous practice, with the result that a theatre in a community with no new factories and no expansion of old ones, may be harmed by developments in a distant community with which its lines were never linked in the past.

Secondly, any damage resulting from line voltage fluctuation is likely to injure the theatre much more than it would have in other times, because of probable delays in obtaining replacement parts, and particularly such parts as power transformers which are most directly exposed to any change in the power supply.

Third, line voltage regulators, always hitherto available to any theatre that had occasion to buy one, may also be obtainable only after long delay from this time on.

Not one, but several things, should be done about it, at once. To begin with, don't assume that your theatre doesn't have this particular trouble. You may never have had it, but have it now or have it coming shortly. Watch your power supply. Watch amplifier meters for fluctuation not justified by extremely loud sound volume. If there is any doubt, the power company may be asked to install a portable recording voltmeter for a week. (There is usually no charge for this service—though right now you may have to wait your turn to get it.) Even if regulation at present is good, it may be advisable to ask the power company what it thinks of the chances of maintaining good regulation throughout the emergency.

Regulating Equipment

If line voltage fluctuates seriously, or if the power people admit that it may do so hereafter, through causes which they now cannot control, consider putting in regulating equipment, more seriously than in the past. Of course, no apparatus breakdown ever does a theatre any good, but today, with chances that repair parts may be long delayed, the whole question of voltage regulating equipment should properly be reviewed in the light of new conditions.

In default of regulating equipment, the precaution of additional fusing may prove very much worth while. Fuses can't protect the show if the line voltage swings too far—but they can protect the apparatus. In addition to more careful fusing of separate items of equipment, it may also be very desirable to fuse their internal components individually. This is particularly true of amplifier power transformer and filter condensers, which can be protected by midget fuses. Given data on the maximum voltage fluctuation present or to be expected in any given projection room, the manufacturer of the amplifier can advise in detail on external and internal-midget fusing that will afford additional protection.

FACTORS AFFECTING SOUND IN THEATRES

(*Continued from page* 11)

ground) an external shield of the type that fits around glass tubes. Occasionally, although less often, similar substitutions can be effected in the industrial type tubes used in some sound systems.

Power transformers present considerable difficulty. If the plate transformer and filament transformer are separate units, the situation is a little simpler. A substitute for either can probably be found (even though at second hand) among available radio supplies, although this is not true of all amplifier transformers. It may be that such a substitute offers supplementary output circuits for which the theatre has no use. Depending on the transformer, these can either be ignored, or operated through bleeder resistors installed for the purpose, which absorb the power created without making use of it, but protect the transformer. Where the power transformer includes both filament and plate windings, and either one or the other becomes inoperative, the good winding may be continued in use, and a substitute transformer found for filament or plate supply only, as the case may require. Even if the unit becomes entirely inoperative through failure of its primary winding, it is still not necessary to match its exact combination of filament and plate characteristics. Find one substitute to supply the plates of your tubes, and another and different unit to supply their filaments, if need be. While in a few cases no substitution will be practical, some combination of emergency replacements can probably be found in almost any community.

Coupling transformers and loudspeaker transformers also present difficulties. Coupling transformers in amplifiers of early design can be dispensed with by wiring the amplifier for condenser coupling. This will cost between 3 and 15 db of amplification, as a rule, but probably that can be made up at the volume control. Even if it can't, weak sound is better than none. Where the coupling transformer constitutes the input to a stage of push-pull amplification substitution can be effected by adding a tube to serve as phase inverter. Amplifier rewiring to take the place of inoperative coupling transformers is certainly not within the normal responsibilities of the projectionist, although a good many men today can tackle it successfully. However, any projectionist can have it done, and there is in every community of any size someone who knows how to do it, and can do it in an hour or two.

According to conventional methods of projection room operation down to the present day, many of the prescriptions suggested above (and they don't cover the whole problem, merely touch a few of its highlights)—many of these suggestions will seem decidedly unusual. But what to do if you wire for a part in a hurry, and the supplier answers: "so sorry, but we're making dingbats for MacArthur and we'll get around to you in six weeks, maybe!" What to do? Obviously unusual things have to be done in these unusual times. Where the theatre is buying projection room service a great part of the responsibility will be absorbed by the servicing corporation and its engineering chiefs. But in every theatre the projectionist still must shoulder added responsibility if only as the technical representative of that particular theatre in projection room matters. In many houses he will have to develop a whole new bag of tricks for which he had little or no use before this emergency appeared.

EQUIPMENT DEALERS' SESSION

Chicago—The Theatre Equipment Dealers Protective Association will hold a three-day meeting at the Stevens Hotel starting Saturday, April 25 and extending through Monday, according to Ray G. Colvin, secretary of the organization.

Advancement of Sound Pictures Grows As Engineers Improve Technique

(*Continued from page* 13)

the motion picture industry today, is almost unbelievably higher than that existing in 1930.

One of the most disturbing characteristics of the earlier film sound records, was the high level of film background noise. The average level of this noise was determined by the unmodulated track density in the case of the variable-density record, and by the width of the clear portion of the unmodulated sound-track in the case of the variable-area record. The noise level of a typical unmodulated sound-track was seldom more than 30 to 35 db below the maximum sound level that could be obtained from a fully modulated track. As a consequence, those intimate scenes in a picture which required the use of relatively low level dialog or background music suffered greatly during reproduction. The introduction of sound-track employing noise reduction in 1930 extended the volume range of the sound record by 10 to 15 db and made possible sound-on-film recording with a much greater volume range than that which could be obtained on disks. Basically, noise reduction on variable-density film is secured by making the average transmission of the print sound-track proportional to the amplitude of the sound being recorded at any given instant. In variable-area sound-track, to reduce noise, the average width of the clear portion of the track is made proportional to the amplitude of the sound being recorded at any given instant.

At approximately the same period during which noise reduction was being adopted, the technic of recording had become sufficiently standardized so that some thought could be given to the improvement of frequency characteristics and to microphones, amplifiers, and theatre speaker equipment. The first of the Western Electric moving-coil microphones and of the RCA velocity microphones were made available to the industry in 1930. Whereas, it had been necessary to mount the microphone amplifier employed with the condenser microphone as close to the microphone as practicable, the moving-coil and ribbon-type microphones permitted a considerable length of cable between the microphone and the microphone amplifier. Microphone boom construction was correspondingly simplified and considerably greater ease of following action on the set with the microphone resulted. In addition, both the new microphones exhibited very much better frequency-response characteristics than did the condenser microphone.

The first of the so-called wide-range recordings was released in 1932. These served to indicate not only the added naturalness which could be achieved by extending the frequency range, but, and what was probably more important, brought to the attention of the equipment manufacturers and recording engineers the high degree of distortion that existed in the various components of the recording and reproducing channels. Whereas the earlier standard recordings in many cases exhibited quality which was somewhat telephonic in character, the extended-range recordings exhibited an unpleasant boominess and excessive sibilance which was extremely annoying. Investigations which followed indicated the necessity for equalizing the recording channel in such a manner as to decrease the low-frequency response on dialog recordings. A portion of this equalization has been found necessary to compensate for the difference between the dialog level existing at the position of the microphone during recording and the higher reproduction level existing in the theatre. Another portion of this equalization, somewhat variable in amount, appears necessary to eliminate boominess, or low-frequency reverberation, of studio sets. Within the past few years, some thought and study have been directed to the determination of the character and amount of recording channel equalization necessary to compensate for variations in speech effort and corresponding changes in spectral energy distribution of the actors' voices during their performances.

Distortion

Changes in degree of channel equalization and the insertion of low and high-pass filters of various sorts did little more, however, than reduce the degree of objectionable distortion existing during projection. It, therefore, became necessary to investigate in detail the distortion characteristics of each component of the recording system as completely as possible. It was soon found that few, if any, of the amplifiers employed in the recording channel were nearly as free of distortion as had been assumed and a long program of amplifier redesign was undertaken. New distortion testing equipment made it possible to analyze accurately the amount of distortion caused by the recorder modulator units and by film processing, while further studies indicated the need for higher-powered, lower-distortion theatre amplifier and speaker equipment.

Amplifier distortion was reduced to an acceptable value by the use of transformers having improved frequency-response and impedance characteristics, by the use of larger vacuum tubes, by judicious use of negative feed-back and in cases where considerable power output was required, by the use of carefully balanced push-pull stages. The development of heater-type vacuum tubes had progressed to a stage which permitted the design of completely a-c operated amplifier equipment for the entire recording channel. As a result of these improvements in design, the amplifiers employed today have extremely low signal distortion at full recording levels and have excellent frequency-response characteristics. The bridging amplifier employed by Warner Bros., for example, has a gain of 11 db at 1000 cps, with a maximum deviation from this value of but 0.3 db between 30 and 12,000 cps, and will deliver a power output level of +22 db referred to six milliwatts with a distortion of less than 0.5 per cent at all frequencies between 60 and 8,000 cps. The combined hum and noise level of either of these amplifiers is approximately —85 db with respect to six milliwatts.

The distortion introduced by the recording machine modulator unit has been brought to a satisfactory low value by redesign of the light-valves and galvanometers and by decreasing the effective width of the recording slit image on the film. Further reduction of distortion in original recording has been made possible by the use of push-pull sound-track. It is interesting to note that one of the first patents on push-pull recording was issued in 1911, but no practical application was made of this method in motion picture production until 1935.

In Class *A* push-pull recording two sound records are photographed side by side along one edge of the film, one being 180 degrees out of phase with the other. Each of the tracks is in itself similar to a standard sound-track and by combining the signal resulting from the two sound-tracks out of phase, the even order distortion components introduced by undesirable film and processing characteristics are practically eliminated.

Class *B* push-pull recording differs from Class *A* in that each of the individual tracks recorded contains only one-half of the sound-wave form. That is to say, all the positive half-cycles of the sound-wave are recorded on one of the tracks and all the negative half-cycles of the sound-waves are recorded on the other track. During reproduction of Class *B* sound-track the original wave-form is obtained by proper re-combination of the wave-forms appearing on the two sound-tracks.

One of the principal requirements which must be satisfied by the record-

ing and reproducing mechanisms of a sound motion picture system is that of providing absolutely uniform motion of the film as it passes the light-beam in the recorder and in scanning beam in the reproducer. Non-uniform motion of the film in either case causes frequency modulation of the signal and is particularly objectionable during the reproduction of music or relatively long sustained tones. The frequency modulator, or "flutter," is particularly noticeable when caused by rapid acceleration and deceleration of the film. The newer recorder and reproducer drive mechanisms have been designed to eliminate this type of distortion of providing free-running film-loops between the pull-down and take-up sprockets and the point of scanning. Critically dampened film-driven recording and reproducing drums support the film at the point where it passes the recorder or reproducer light-beam. Heavy flywheels are provided on both the recorder and projector motors to reduce to a minimum any variations in motor speed, and all gears employed for speed reduction purposes are carefully ground and fitted to avoid generation of speed variations by the gear mechanisms.

The recording machine designed by RCA utilizes a very simple, but most effective, means of securing uniform film motion. The driving motor is coupled through gears to a magnet structure which rotates coaxially with, but independently of, a heavy flywheel mounted on the end of the recorder drum shaft. The magnet structure is driven at a slightly higher angular velocity than the normal velocity of the recording drum. Eddy currents induced in the rim of the flywheel caused the drum shaft to rotate at such angular velocity that the peripheral velocity of the drum is just equal to the normal average film velocity through the recording machine. In normal operation of the recorder, a free-running film loop exists on either side of the recording drum, and exposure of any point on the film occurs at a point midway along the wrap of the film on the drum. This mechanism provides an extremely high degree of stabilizing action since there is no direct mechanical drive of the film at the actual point of exposure. This type of recording machine introduces the equivalent of 0.03 to 0.10 per cent frequency modulation as compared with 0.2 to 0.7 per cent of the older machines.

The earlier printers used for producing positive sound-tracks by contact printing from the negative were found to be a prolific source of both frequency and amplitude modulation. A part of the difficulty was insufficient contact between the negative and print stocks. Slippage of the positive film with respect to the negative at the instant of print exposure also contributed to the difficulty. The non-slip printer design introduced in 1936 provided a means of practically removing film slippage during the printing operation. Present-day sound printers provide very positive means of maintaining an extremely high degree of contact between negative and print stocks and utilize an exposing light-beam whose width is of the order of 0.005 to 0.008 inch. By restricting the length of the sound-track exposed at any given instant, the effects of such slippage as may still occur are greatly minimized.

Loud Speaker Systems

Most of the early theatre speaker systems employed large horns equipped with one or more motor units behind the screen. While the efficiency of some of these speakers was reasonably high, they were deficient in both low and high-frequency reproduction. One of the early attempts to overcome the defects of the theatre speaker employed three speaker units: one for reproduction of the very low frequencies, one for reproduction of the middle range of frequencies, and one for the reproduction of the extremely high frequencies. Suitable dividing networks inserted between the power amplifier and speaker terminals provided proper energy distribution to the three speakers. Considerable difficulty was experienced with such systems in properly phasing and positioning the individual speakers so that uniform distribution of energy throughout the theatre auditorium could be obtained. Recent developments in speaker design have given us the two-way speaker system which employs one or more dynamic speakers in suitable baffles for reproduction of all frequencies below about 300 cps, and a multicellular horn equipped with one or more speaker units for reproduction of all frequencies above 300 cps. This type of speaker installation has become standard in all of the studio review rooms and in all recently equipped theatres throughout the country to provide satisfactory reproduction of all frequencies between 50 and 7000 cps.

The volume range that may be obtained from a high-quality variable-area sound-track, such as employed by Warner Bros., is of the order of 50 db. For many years it was assumed that naturalness of sound in the theatre was more or less proportional to the reproduced volume range which could be secured

from the sound print. It has since been found, however, that it is an easy matter to provide too great a volume range for satisfactory theatre reproduction. The general noise level which exists in a theatre, caused by normal audience movements, heating systems, ventilating systems, and operations in the projection booth, determine the minimum sound level necessary for a high degree of intelligibility. The type of scene portrayed on the screen and general comfort of the theatre patrons, on the other hand, determine in a general way the maximal sound level which may be employed. Studies of a large number of theatres have indicated that the difference between the maximum level and the minimum level varies between 25 and 35 db. Since the volume range existing in the original dialog and music recorded for a picture is usually considerably in excess of 40 db, it is evident that satisfactory reproduction in a large variety of theatres can only be obtained if an arbitrary reduction in volume range is accomplished. To this end, electronic volume compressors are installed in each of the recording and re-recording channels at the studio, and are normally operated so that the original volume range of 50 db is compressed to a final volume range of the order of 30 db.

The compressors used in recording are essentially amplifiers whose gain is controlled by the instantaneous peak value of the signal passing through the amplifier. Gain control is effected by rectifying a portion of the signal current and impressing the rectified voltage on the control grids of a pair of remote cut-off amplifier tubes in the compressor units.

The time-constants of the rectifier circuits are so chosen that a change in gain of the compressor is accomplished in approximately one millisecond.

Films for Recording

A resume of developments in the sound-recording field would be incomplete without reference to the advances made in the manufacture of film stocks for recording purposes. The early variable-density sound-negative records made at Warner Bros. Studio were recorded on Eastman type 1301 positive film stock with development carried to a gamma of approximately 0.4. This film was originally designed for use as a print stock, the development of which would be carried to a gamma of 2.0 to 2.4 and was, therefore, somewhat low in sensitivity for recording purposes. In September, 1932, the Eastman Kodak Company made available type 1359 recording stock which had a speed of approximately 2.5 times that of the type 1301 emulsion. This increase in film speed made it possible to reduce the recorder exciter-lamp current by an amount that increased the lamp life several hundred per cent, and decreased the variation in negative sound-track density which had previously been caused by lamp instability.

The 1359 type emulsion was used by Warner Bros. until the introduction of ultraviolet recording in 1936. At this time the advantages of employing variable-area ultraviolet recording appeared sufficiently great to justify a complete change in plant recording equipment and the RCA variable-area machines were installed. At this time Eastman made available their type 1357 emulsion which had approximately twice the speed of the type 1301 emulsion to ultraviolet light and this stock is employed for sound negative at the present time.

On October, 1937, Eastman type 1360 fine-grain positive film was tested as a negative recording stock and found to be somewhat superior to the type 1357 film in both high-frequency response and background noise. A number of productions were recorded employing this stock for the sound negative until it was determined that similar improvements could be obtained by utilizing this stock for prints employed for re-recording purposes.

In December, 1939, Eastman announced the replacement of the type 1360 emulsion by the type 1361, a film of somewhat lower inherent contrast, and of such spectral sensitivity as to permit handling it under positive-type safelights. In all other respects this film is similar to the type 1360 emulsion and results in an increased high-frequency response of approximately 1.5 db at 9000 cps and a reduction in film background noise of approximately 6 db.

In order to provide negatives from which release prints can be made in the various countries, and to provide insurance against the possible destruction of the original picture and sound negatives, it is customary to prepare duplicate negatives of the picture and sound-track negatives by photographic means. The process invovles making a composite master print from the picture and sound negatives and by a second printing operation, securing a composite duplicate negative of the original. Until recently, the composite master print was made on Eastman type 1362 lavender stock and a "dupe" negative was made from this on Eastman type 1217 panchromatic negative stock. Prints made from the duplicate negatives, when compared with the original, showed an average increase in film background noise of approximately 5 db, a loss in volume of approximately 2 db, and a reproduction loss of 6 db at 9000 cps.

In the latter part of 1937, Eastman introduced its fine-grain duplicating positive stock, type 1365, and a fine-grain duplicating negative stock, type 1203. These films have been substituted for the lavender positive stock and panchromatic negative stock previously employed in making duplicate negatives and prints from this new stock show an increase in surface noise of only one db, a loss in sound level of one db, and a loss in high-frequency response of only one db at 9000 cps as compared to the original. This improvement in duplicating stocks represents a remarkable achievement in film manufacture and permits the production of prints from duplicate negatives that can not be distinguished from prints of the originals.

It is evident that the exercise of the greatest care and use of the latest recording equipment and materials will

be of little value unless the improvements achieved in recording can be reflected in the quality of reproduction obtained in the theatre. Warner Bros. has recently completely re-equipped its entire chain of theatres with the latest type of RCA reproducing equipment. This change involved the installation of new type sound-heads equipped with rotary stabilizers to secure uniform film motion at the point of scanning, new amplifiers of greater power handling capacity and lower distortion than those previously employed, and two-way loud speaker systems capable of reproducing, with a minimum of distortion, the entire audio spectrum recorded on the sound-track. While the majority of the theatre reproducing units are of very rugged construction, highest quality of reproduction can be obtained only if the reproducing equipment is frequently checked and serviced. This work is accomplished by a theatre engineering service group, and by this means it has been found possible to remove likely sources of trouble or partially defective equipment before a break-down occurs during a performance.

War Board Blocks Television Expansion for Duration

WASHINGTON. — Television will have to mark time for the duration due to an order by the War Production Board, which says there shall be no material used for the purpose of expanding television. The order also hits radio, for it prohibits any new stations or expansion of old ones.

The order reads:

"No future authorizations involving the use of any material may be issued by the Federal Communications Commission nor shall further materials be allocated by the War Production Board to construct or to change the transmitting facilities of any standard, television, facsimile, relay, RM, non-commercial, educational or experimental radio broadcasting station."

Up until a short time ago the Commission intimated that it might permit television to expand as an aid to war but the new order has banned everything. The order follows closely on the order a few weeks ago that banned new equipment to the motion picture companies in spite of the fact that the picture people insisted that it was doing its all for the soldiers.

STROUDSBURG HOUSE DESTROYED

Stroudsburg, Pa.—The Sherman theatre, this city's largest theatre, has been destroyed by fire. The fire started shortly before the house was scheduled to open for a matinee and caused damage estimated at $100,000.

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Monthly Chat

UNLESS all signs mislead, the projectionist is about to face the same necessity that confronted him in the early days of sound—namely, the compulsion to increase his general stock of information along lines that previously were of no practical importance to him.

Two entirely different forces seem to be operating to place this necessity for more education on projectionists at the present time. One is the emergency itself. Shortages of vital materials will result in the use of more or less unsatisfactory substitutes in some projection room supplies—and the feller who puts on the show will have to struggle along with that handicap. The troubles resulting therefrom, and some slowness in shipping replacements, some shortage of loan equipment, will increase the projectionists' responsibility for more careful routine maintenance and inspection, and call on him for greater ingenuity in making emergency repairs.

But a second factor, to which all far-seeing men will pay careful attention, is the strong likelihood, amounting to practical certainty, that new and revolutionary techniques will come out of this war, and eventually find their way into projection. The last war created radio as a mass industry, with talking pictures as an inevitable offshoot. That television as a mass industry—including theatre television—will follow this war, and utilize techniques now secretly being developed for military use, is at least highly probable. But what else may develop can no more be predicted now than radio or talkies could have been foretold in '17. Improvements in optical practices suggest themselves as a possible result of intensive research now going into bombsights and the like; revolutions in amplification may grow out of wartime communications science, and so on. Neither the projectionist nor anyone else—not even the men now doing military researches—can say today what the American projection room will be like technically five years after the war ends. Nor can the projectionist study today the details of those techniques he will need five years hence.

What he can do, and the times seem to be imposing the obligation upon him, is to study more intensively and thoroughly than ever in the past, the principles of optics in general, and of amplification in general, and so on. He can't get more details now. He can and must get more background now—both to meet his responsibilities during the war and to be prepared for the surprises that will come when it is over.

Any dissenting votes?

INTERNATIONAL PROJECTIONIST

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Projection Room Uses of Tube Data

By LEROY CHADBOURNE

COMPLETE data on tubes used in the projection room are made available by all tube manufacturers. There is in fact no item of projection room equipment on which more detailed information is open to the projectionist. However, as the tube is a complex device, the information covering it is also complex, and even today not all projectionists have learned to interpret the forms in which it is presented.

Tube information is published in two general forms—booklets and charts; in addition, data sheets are included in the wrappings of some tubes delivered to the projection room. Tube books or charts can be obtained from any tube manufacturer, sometimes without cost, sometimes at a very small charge.

Tube data, from whatever source obtained, can profitably be used as a guide to correct performance of sound equipment and to advance warnings of impending trouble; in trouble-shooting and in effecting repairs; also in suggesting and guiding temporary substitutions, both of tubes and of other parts, if the correct replacement cannot be obtained promptly.

Tube data as normally presented will include: voltages, for filament or heater, and for all grids and plates; current, for filament or heater, plates, and grids in cases where the grid draws current; the characteristics of associated parts, usually the value of the plate resistor, often the value of a cathode-bias resistor and the permissible impedance of the speech input circuit; the layout of socket connections and physical dimensions of the tube—these last being very helpful in considering emergency replacement with a tube of identical electrical characteristics but different type number. Amplification factor and transconductance as a rule are also given in the case of amplifying tubes, although these are of less practical importance to the projectionist.

Specifications Varied

It is very important to note that the tube may not be used according to the specifications of its manufacturer. Manufacturers' data do not list all the possible ways in which a tube can be used. However, some of the standards specified by the manufacturer are invariable, and cannot be changed. Concerning others, it may be necessary to check back with the manufacturer of the amplifier or other equipment; but in all except a few cases the reply will refer an inquirer back to the tube manufacturers' data book or chart, or data slip.

The simplest information, of course, is that relating to the rectifier, as the simplest type of tube. Fig. 1 and Table 1 reproduce the most significant data in an RCA tube manual, concerning a rectifier widely used in projection rooms. The illustration gives the physical dimensions of the tube and its socket connections. The latter information is valuable in all trouble work unless the socket itself is plainly marked and the markings have not faded or otherwise become illegible.

The tabulation lists first of all the filament voltage and the filament current, *which are invariable.* In any equipment, by whomever designed, this tube will operate at the filament voltage and current here shown. The next item of information is the plate voltage, which need not always be the maximum of 500 as here given. If, however, a rectified output of 250 milliamperes, as listed further down, is required by the apparatus, the maximum plate voltage will be applied.

The peak inverse voltage is the extreme potential between that plate which is negative at a given moment, and the filament. Since a.c. is involved, that voltage will not be the average or effective (rms) voltage, but the real peak at the momentary maximum of the alternation, which is 1.4 times the effective voltage, and (with some filter circuits, in which a condenser acts as voltage doubler) may rise to 2.8 times

the rated or rms potential. The practical point for the projectionist is not one of voltage measurement, however, but, in all cases where there is any occasion to substitute one type of rectifier tube for another of different type number, it is essential to check the inverse peak voltage rating of both, as given in the data, to make sure the temporary substitute will not break down and arc over in operation. If it is rated for a smaller peak inverse voltage than the tube it replaces, that may happen.

Table 1 is reproduced from a tube book—on a tube chart the same information would be spread out under suitable headings. This is illustrated in Fig. 2, a reproduction of a portion of a tube chart issued by the Raytheon Corporation, in which the third line from the bottom duplicates the data given in Table 1. The peak inverse voltage is not listed on the chart (it is identical with that of the RCA 5Z3). The physical dimensions are given in the sixth and seventh column — obviously the larger dimension refers to the length of the tube, the lesser to its extreme diameter. It will be noted the dimensions are identical with those shown in Fig. 1. The fifth column names the type of socket—illustrations comparable to the right half of figure 1, to which the data in the fifth column may be referred, are printed on another part of the chart, not reproduced here.

The information at the right of the chart, showing the nominal maximum voltages delivered to filters of different types, is represented in the tube book by a small graph printed on the same page, not reproduced here. This detail is not of much value to the projectionist. The book gives some additional data which a chart cannot easily provide, including a reminder that this tube needs adequate ventilation.

Amplifying Tubes

Fig. 3 reproduces a portion of a tube chart (also by Raytheon) covering a tube widely used in modern projection rooms. The column at the extreme left, showing the letter 'M', indicates in this particular chart that the tube is a metal tube. Next to the right comes the type number, 6J7, then the type, pentode, and the nature of the cathode, heater, not filament. The next column, giving information as to the socket, refers to a series of views, not reproduced here, similar to the right

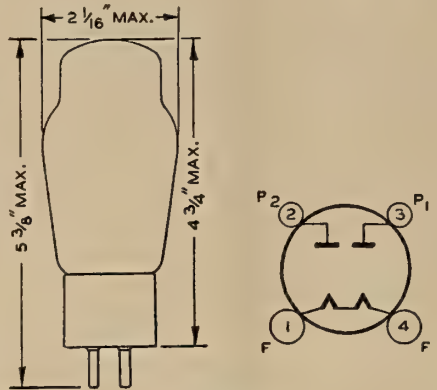


FIGURE 1

portion of Fig. 1. Then the physical dimensions are given, followed by the "filament" — i.e., cathode heater — current. Note that the cathode *voltage* is not listed. It need not be, because in this chart (as in some others) all tubes of the same cathode voltage are grouped together, and the 6J7 is listed in the group of tubes that have 6.3 volt cathodes. (The same information is given by the first figure of the tube number—6. If a 2J7 is ever produced, it will be essentially the same tube with a 2.5 volt cathode. Similarly the 2A3 is a 2.5 volt filament type, and the 6A3 essentially the same tube with a 6.3 volt filament.)

The internal capacitances, next listed, are not of much importance to the projectionist. In the column that follows, it is indicated that this tube can be used both as a detector and as an amplifier. Its application as a detector is of no practical interest in projection. Therefore all data on the top line which begins at this point, may be ignored.

In use as an amplifier, 250 plate volts is specified, but the succeeding column shows that the screen grid voltage may be either 125 or 100 volts. In either case the grid voltage is 3 (negative), but the plate current is 4 mils with a 125 volt screen potential, and 2 mils with a 100 volt screen potential. By inquiry of the manufacturer of any amplifier using this tube, or by direct measurement with a high resistance voltmeter, the projectionist may ascertain which screen voltage is used at each socket in his own projection room where one of these tubes is installed, and roughly judge what his plate current should be, accordingly.

The chart next gives the amplification factor, but only in case of a 100-volt screen potential. The gain of 2500 is the *voltage* gain. That is, a swing of 1/2500th volt at the control grid of this tube has the same effect on the plate current as a difference of one volt at plate under Ohm's Law. This voltage gain is not wholly realized in practice, one of the factors influencing performance in this respect being the resistance of the plate load. The succeeding column suggests that the plate resistor should be one of two megohms, but a somewhat smaller value may be used in practice. The mutual conductance (transconductance) follows. This factor expresses the effect of a change of grid voltage in producing a change in plate current; it is obtained by dividing the amplification factor by the plate resistance. Expressed in mhos—the mho is ohm spelled backward—this would come out a fraction, hence is always expressed in micromhos: just as condenser capacitances are expressed in microfarads, not in farads. The final column shows the cut-off grid bias—that is, the negative bias which, if applied to the control grid, would reduce the plate current substantially to zero.

The tube book or manual, having more space at its disposal than a chart,

FIGURE 2

RECTIFIER TUBES

							FIL. AMPS.	FIL. VOLTS	MAX. AC VOLTS PER ANODE	MAX. DC OUT CURR. (AMPS)	MAX. PEAK INVERSE VOLTS	MAX. PEAK PLATE CURR.	MIN. CHOKE BEFORE FILTER CONDENSER	MAX. HEATER CATHODE BIAS	MAX. DC VOLTS DEL. TO FILTER (NOM.) CONDENSER INPUT	CHOKE INPUT	
8A	FULL WAVE	GAS	COLD	-F- MED. 4 PIN	5 5/8	2 7/16			350	0.350						300	8A
8H	FULL WAVE	GAS	COLD	-F- MED. 4 PIN	4 5/8	1 13/16			350	0.125						300	8H
8R	HALF WAVE	GAS	COLD	-G- MED. 4 PIN	3 3/4	1 9/16				0.050	600					200	8R
1-V	HALF WAVE	HIGH VACUUM	HEATER	-S- SM. 4 PIN	4 1/4	1 9/16	0.3	6.3	350	0.050	1000	0.400		300	310		1-V
80	FULL WAVE	HIGH VACUUM	FIL.	-D- MED. 4 PIN	4 11/16	1 13/16	2.0	5.0	350 400 550	0.125 0.110 0.135			20 HENRIES		300 370	225 275 425	80
81	HALF WAVE	HIGH VACUUM	FIL.	-E- MED. 4 PIN	6 1/4	2 7/16	1.25	7.5	700	0.085					675	475	81
82	FULL WAVE	MERCURY VAPOR	FIL.	-D- MED. 4 PIN	4 11/16	1 13/16	3.0	2.5	500	0.125	1400	0.400			575	425	82
83V	FULL WAVE	HIGH VACUUM	HEATER	-D- MED. 4 PIN	4 11/16	1 13/16	2.0	5.0	500	0.250	1400	0.800			500	400	83V
84	FULL WAVE	HIGH VACUUM	HEATER	-T- SM. 5 PIN	4 1/4	1 9/16	0.5	6.3	225	0.050	700	0.150		300	270	185	84
5Z3	FULL WAVE	HIGH VACUUM	FIL.	-D- MED. 4 PIN	5 3/8	2 1/16	3.0	5.0	500	0.250					475	360	5Z3
12Z3	HALF WAVE	HIGH VACUUM	HEATER	-S- SM. 4 PIN	4 1/4	1 9/16	0.3	12.6	350	0.060	700	0.250		300	310		12Z3
25Z5	VOLTAGE DOUBLER	HIGH VACUUM	HEATER	-V- SM. 6 PIN	4 1/4	1 9/16	0.3	25.0	125	0.100	700	0.400		300	200		25Z5

M

TYPE NO.	DESCRIPTION: USE	DESCRIPTION: TYPE	DESCRIPTION: CATHODE	BASING SEE VIEW AT RIGHT	MAX. DIMEN. OVERALL: HEIGHT	MAX. DIMEN. OVERALL: DIAM.	FIL. CURR. AMPS.	CAPACITANCES MICRO-MICRO-FARADS: GRID PLATE	CAPACITANCES: INPUT	CAPACITANCES: OUTPUT	WHEN USED AS	PLATE SUPPLY VOLTS	SCR. GRID VOLTS	GRID BIAS VOLTS	PLATE CURRENT M.A.	AMPL. FACTOR	PLATE RESIS. OHMS	MUT. COND. µMHOS	MAX. UNDIST. OUTPUT WATTS	RECOMM. LOAD RES. OHMS	CUT-OFF BIAS VOLTS	TYPE NO.
6J7	DETECTOR AMPLIFIER	PENTODE	HEATER	7R OCTAL 7PIN	3⅛	1 5/16	0.30	0.002	8	12	DETECTOR	250	100	3.8						0.25 MΩ		6J7
											AMPLIFIER	250	125	3	4			1550			9	
												250	100	3	2	2500	2.0 MΩ	1225			7	

FIGURE 3

can go into greater detail, as shown in Table 2, which refers to this same tube, the 6J7. Note first of all, toward the bottom of the table, that this tube can be used as a triode, instead of a pentode, by so wiring the socket that the screen grid and the suppressor grid are directly connected to the plate. This is exactly what is done in some theatre circuits. In fact, the same tube may be used both ways in the same amplifier—as a triode in one socket and as a pentode in another. Its operating characteristics, and the values of its associated resistors, then vary as shown in Table 2.

Data Not Always Followed

The projectionist may find that any given tube in his own equipment does not operate exactly according to either chart data or book data; on this point he may consult the manufacturer of his equipment, or study the circuit diagram of his amplifier and take voltage readings (with a high resistance meter) at a time when everything is operating normally.

The first two lines of Table 2 give cathode or heater data, which is always invariable, and the same in both book and chart. The next six lines, giving details as to capacitance, are not of great value to the projectionist.

Characteristics of the tube operating as a pentode occupy the next section of the table. The first six lines of this section refer to allowable maxima and minima, and again are not of great value in the projection room. The seventh line declares that those that follow refer to "typical operation"—as a pentode. The next line shows that in typical operation this tube may be supplied with either 100 or 250 volts plate potential. (It may also be operated at voltages between those values). Screen voltage in both cases is given as 100—but the chart showed that 125 screen volts might be used. The grid (control grid) voltage is shown as —3 regardless of whether the plate potential be 100 or 250—the plate current is also shown as the same in both cases. This is explained by the plate resistance figures, 1 megohm for 100 volts plate potential, but a resistor of some unnamed higher value when the greater voltage is applied to the plate. The grid cut-off voltage is the same as that shown in the chart, —7; the amplification factor is not listed.

The final section of the table gives the characteristics for triode operation—here note that the amplification factor is only 20, as against 2500 in Fig. 3, but the transconductance is 1900 as against 1225 in pentode operation—that is, as a triode the tube is a less efficient voltage amplifier but somewhat more efficient as a power amplifier.

Figure 4, also of course from the tube book—charts have no space for such details—is graph expanding the information contained in Table 2. The vertical lines represent plate volts, the horizontal lines plate current, and the curved lines control grid bias. Consider for example a plate potential of 160—in between the values given previously—and a control grid potential of 2 volts (negative). The curve for two volts grids bias crosses the vertical line representing 160 plate volts in the region between the horizontal lines representing 3 and 4 plate mils—under these conditions of operation the plate current will be about 3.7. But the information printed near the top of the graph tells us that everything in Fig. 4 applies only if the screen grid voltage is 100 volts.

Tube data, as supplemented by the manufacturer of the projection room

(*Continued on page* 20)

Table 1

Filament Voltage (A. C.)	5.0	Volts
Filament Current	3.0	Amperes
A-C Plate Voltage Per Plate (RMS)	500 *max.*	Volts
Peak Inverse Voltage	1400 *max.*	Volts
D-C Output Current	250 *max.*	Milliamperes
Bulb		ST-16
Base		Medium 4-Pin

Table 2

Heater Voltage (A.C. or D.C.)		6.3	Volts
Heater Current		0.3	Ampere
Pentode Connection:	*Type 6J7**	*Type 6J7-G*	
Grid-Plate Capacitance	0.005 *max.*	0.007 *max.***	µµf
Input Capacitance	7	4.6**	µµf
Output Capacitance	12	12**	µµf
Triode Connection:			
Grid-Plate Capacitance	2	1.8°	µµf
Grid-Cathode Capacitance	5	2.6°	µµf
Plate-Cathode Capacitance	14	1.7°	µµf

*With shell connected to cathode. **With close-fitting shield connected to cathode.
°Without shield-can.

As Class A_1 Amplifier—Pentode Connection

Plate Voltage		300 *max.*	Volts
Screen Voltage (Grid No. 2)		125 *max.*	Volts
Screen Supply Voltage		300 *max.*	Volts
Grid Voltage (Grid No. 1)		0 *min.*	Volts
Plate Dissipation		0.75 *max.*	Watt
Screen Dissipation		0.1 *max.*	Watt
Typical Operation:			
Plate Voltage	100	250	Volts
Screen Voltage	100	100	Volts
Grid Voltage‡	–3	–3	Volts
Suppressor	Connected to cathode at socket		
Plate Current	2	2	Milliamperes
Screen Current	0.5	0.5	Milliampere
Plate Resistance	1.0	†	Megohm
Transconductance	1185	1225	Micromhos
Grid Voltage (Approx.)°°	–7	–7	Volts

°°For cathode-current cut-off. †Greater than 1.0 megohm.

As Class A_1 Amplifier—Triode Connection

(Screen and suppressor tied to plate)

Plate Voltage		250 *max.*	Volts
Grid Voltage		0 *min.*	Volts
Plate & Screen Dissipation (Total)		1.75 *max.*	Watts
Typical Operation:			
Plate Voltage	180	250	Volts
Grid Voltage‡	–5.3	–8	Volts
Plate Current	5.3	6.5	Milliamperes
Plate Resistance	11000	10500	Ohms
Amplification Factor	20	20	
Transconductance	1800	1900	Micromhos

‡The d-c resistance in the grid circuit should not exceed 1.0 megohm.

Color of Light on the Projection Screen†

M. R. Null, W. W. Lozier, and D. B. Joy

MEMBERS OF THE RESEARCH STAFF, NATIONAL CARBON CO., INC.

A FEW years ago, members of the Research Laboratory of our Company made measurements of the spectral-energy distribution of the light from carbon arcs used for photography in motion picture studios and also for projection in motion picture theatres. These measurements pertained to the direct radiation from the carbon arcs and in most cases referred to the crater radiation only. It was realized that in the case of carbon arcs used for projection, the passage of the light through the optical system would result in the selective absorption of light in certain wavelength regions and so alter the resultant color on the motion picture screen. Also the variations between the color of the light emitted from the crater and the adjacent portions of the arc are difficult to assess as regards their influence upon screen light. Since the factors described above are variables dependent upon the characteristics and adjustment of each particular optical system, their effect was not included in the earlier general description of the radiation from the arc itself. In each installation, however, the effect of the projector optical system on the color of the light must be recognized and we have recently evaluated the spectral-energy distribution of the light on the projection screen for a number of individual cases of lamps, optical systems, and carbons. These results give us new and interesting information and, so far as we know, represent the first measurements of the spectral-energy distribution on the projection screen.

† *J. Soc. Mot. Pict. Eng.* (*Mar.* 1942).

The various projector arcs discussed below were burned in their respective lamps with the customary optical systems, illuminating a bare film aperture. A standard projection lens was used to focus an image of the film aperture on a miniature projection screen about one foot wide. The monochromator employed for measuring the spectral-energy distribution was placed with its entrance slit at the center of the illuminated projection screen. By means of the monochromator and associated thermopile and galvanometer we are able to determine the relative amounts of energy in the various wavelength bands throughout the visible spectrum. While this method of measurement includes the effect of the lamp and projector optical systems upon the color of the light, it does neglect the influence of the projection screen and the motion picture film. If the projection screen is non-selective and reflects equal proportions of all wavelengths falling upon it, then it will not alter the form of the spectral-energy distribution curve or the color of the projection light.

Screen Effect Calculated

If the screen does have some spectral selectivity, the effect can be calculated by employing the spectral reflectance curve of the screen material in combination with spectral-energy distribution data reported in this paper. Similarly, the spectral transmission characteristics of the motion picture film can be combined with the data of this paper to determine the overall effect on the screen.

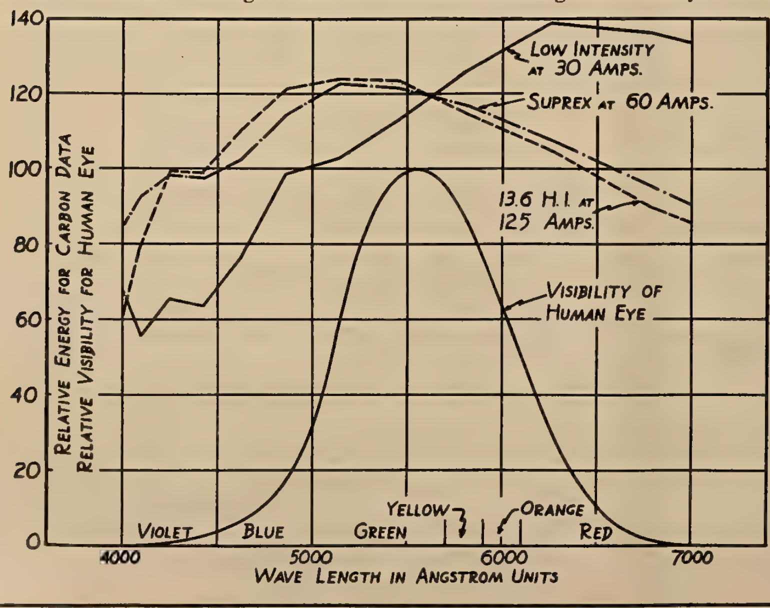
Previous experience with carbon arc projector lamps has shown that when the arc is maintained at the correct distance from the reflector or condenser lens the color over the projection screen has a uniform visual appearance. When the carbons are displaced from the position of correct adjustment, there result changes in the intensity and distribution of the light on the screen. If these displacements become severe enough they may first produce slight changes in color over the entire screen and, later, differences in color between different portions of the screen. It is hoped in the future to be able to present measurements on the extent of these color variations. However, for the measurements reported below, the carbon position has been maintained at the current position to give uniform visual color over the screen and measurements have been carried out only at the center of the screen.

The visible wavelength range extends from 4,000 to 7,000 Å. In Figure 1 is shown the spectral-energy distribution over this visible range of light on the projection screen for three widely used projector lamps and arcs. These include the low-intensity lamp, the Suprex type lamp, and the condenser type lamp burning the 13.6-mm high-intensity carbon at 125 amperes. These spectral-energy distribution measurements tell nothing about the lesser amount of light obtained from the low-intensity system; in fact, for the purposes of this paper the heights of the three curves have been adjusted so they are on the basis of equal visible light. The spectral-energy distribution of the screen light from the low-intensity lamp shows the red radiation as the most plentiful, and relatively lesser amounts of green and blue. The two high-intensity lamps show on the screen a more even balance of energy among the different wavelengths with actually a slight preponderance in the green.

These spectral-energy distribution data can be used to derive further quantities which are widely used in discussion and comparison of visual colors. Two such bases of comparison are (1) the chromaticity diagram, and (2) comparison with a black body.

Chromaticity Diagram.—The use of the ICI chromaticity diagram has been illus-

FIGURE 1. ***Light sources charted according to visibility.***



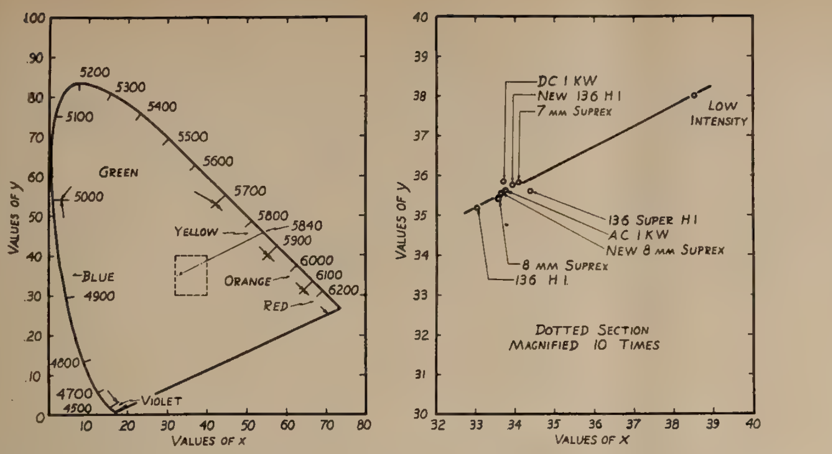


FIGURE 2. ***Light sources charted according to color; the graph at right is an enlargement of the rectangle in the left-hand graph.***

trated in a number of publications in recent years. According to this procedure, it is possible to calculate from the spectral-energy distribution of a light-source or illuminated object three numbers or color-coordinates which specify its color. These are the so-called ICI trichromatic coefficients x, y, and z. Since the sum of these trichromatic coefficients is unity, only two of them are necessary to describe the color. The coefficients x and y can be plotted as coordinates on a chromaticity diagram as shown in Figure 2. The color-coordinates of all pure spectrum colors are known, and when plotted in this manner fall on the curved boundary of this diagram, with the wavelengths of the various parts of the spectrum indicated in Å. All composite colors, which are in reality composed of varying proportions of pure spectrum radiation, will fall within the curved boundary of the chromaticity diagram of Figure 2.

The ICI color-coordinates of the various light-sources studied in our tests have been calculated and are given in Table I. Values for representative currents for each of the combinations shown in Table I have been plotted in Figure 2. It is apparent, particularly from the enlargement shown at the right-hand side of Figure 2, that the colors of the screen light from all the high-intensity arc lamps are in a closely bunched group which is distinctly separated from the color of the low-intensity arc lamp. This chromaticity diagram has the useful property that if the points representing any two component colors are connected by a straight line, then the points representing all possible combinations of these components will lie on that straight line. For example, on Figure 2, a straight line drawn from the center of the group of "high-intensity" points through the "low-intensity" point intersects the boundary of the diagram at 5840 Å, in the yellow part of the spectrum. This explains the color differences observed when these two light-sources are projected side by side. The "low-intensity" color can be obtained by adding yellow light of wavelength 5840 Å to the "high-intensity" light and therefore the "low-intensity" light appears yellow compared to the "high-intensity."

Comparison with Black-Body Radiation.—It is common procedure to compare the color of a so-called continuous-type light-source with that of a theoretical black body, the quality of whose radiation depends only upon the temperature. This comparison is expressed as the color-temperature of the light-source, which is defined as the temperature at which a black body would have to be maintained in order that its radiation would most nearly match the color of the source in question. Using this method of comparison, the color-temperatures of the screen light from the various combinations of lamps and carbons have been determined as shown in Table I. We note that the color-temperature of the screen light from the low-intensity lamp is 3870°K, while the high-intensity screen light ranges from 5020° to 5620°K. The color-temperatures of the Suprex type, the "One Kilowatt" a-c and d-c, and the condenser-type lamps over their recommended current ranges all fall within this range.

The specifications of light-sources by chromaticity or color-temperature are visual ones, based upon eye response and not upon the spectral-energy distribution alone. Thus two sources may match perfectly in chromaticity or color-temperature, even though the spectral-energy distributions of their radiant energies are widely different.

Therefore the practical significance of chromaticity and color-temperature is limited. For a black body, of course, the temperature completely specifies the energy distribution as well as the color. It is interesting to note that on account of the close correspondence of the carbon arc light-sources under consideration to black-body sources, the color-temperature is an unusually good measure of the spectral-energy distribution in these cases as well. Figure 3 shows the spectral-energy distribution of the "low-intensity," "Suprex," and con-

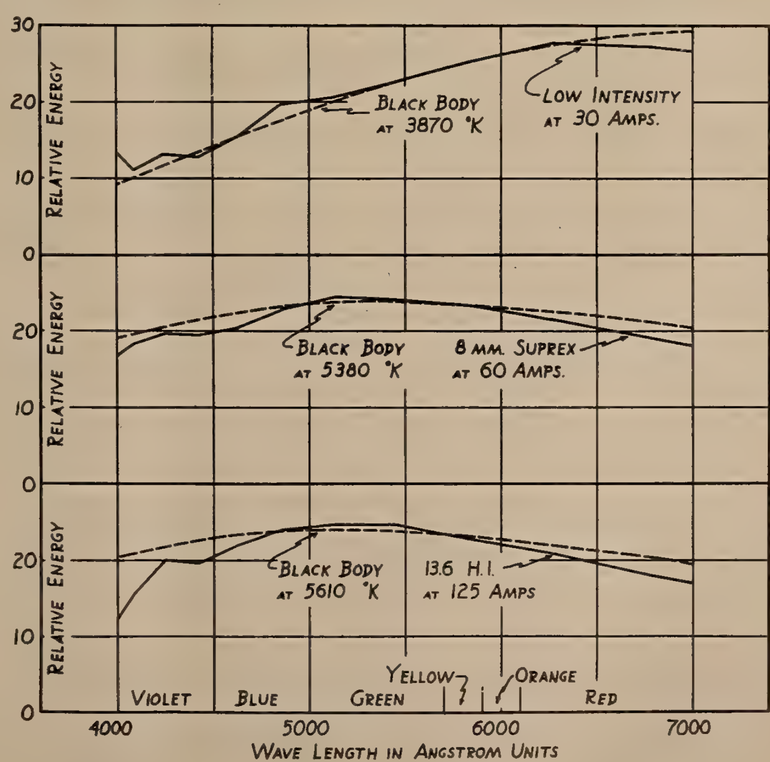


FIGURE 3. ***Light sources compared to black body radiation at high temperatures.***

denser-type high-intensity screen light in comparison with spectral-energy distribution curves for black bodies at the same color-temperature and same candlepower. The spectral-energy distribution of the screen light from the low-intensity projector lamp corresponds quite closely through the visible to that of a black body at the same color-temperature. With the high-intensity lamps the similarity is still almost as good though these arcs have slightly less energy in the red and blue and more in the green than the corresponding black bodies.

Data of Table 1

In Table I are shown also color-temperature values obtained in the earlier measurements on the direct crater radiation from some of these arcs. This has been unaltered by transmission through any optical system and comparison of these values with our values for the color-temperature of the screen light gives interesting information on the changes in color produced by the optical systems of the particular projector lamps used. With the low-intensity lamp and the condenser-type high-intensity lamp the color-temperatures of the light on the screen show relatively small departure from that obtained on the bare sources. The low-intensity shows a little higher color-temperature for the light on the screen compared to the bare source, and the condenser-type high-intensity lamp shows slightly lower color-temperatures on the screen. With the 7-mm and 8-mm Suprex positive carbons the color-temperature of the bare source ranged from 5800° to 6400°K. These light-sources show a color-temperature through the optical system on the screen 800° to 900° lower than the bare sources. This behavior brings the color-temperature of the light on the screen and its spectral-energy distribution into closer agreement with that obtained from the condenser-type lamp and results in a narrow spread of color between all our high-intensity arcs.

There are other factors which can affect the spectral-energy distribution and color-temperature of the light on the projection screen. We have made some preliminary studies of the effect of different lenses and mirrors, and believe that their effect in general will be small. As mentioned above, the position of the carbon with respect to the optical system can influence the color. Increase of carbon distance from the mirror in general causes an increase in color-temperature, although from exploratory measurements this change was of the same order of magnitude as the differences between the various high-intensity combinations shown in Table I. While these minor variations in color-temperature of the screen light from the various high-intensity projector lamp and carbon combinations could probably be discerned by simultaneous comparison side by side, the differences are small in comparison with the familiar difference in color of screen light from the low-intensity and high-intensity lamps.

If subsequent developments, especially in the art and technology of colored motion pictures, indicate the desirability of alterations in the color-temperature of some of these high-intensity lamps, this can to some extent be carried out. Changes in color-temperature can be produced by alteration of the carbon, which has been done for some applications in the past.

The results described in this paper give us assurance that with equipment in good condition and properly adjusted, the popular high-intensity lamp and carbon combinations give remarkably consistent color and spectral-energy distribution. We plan to extend these measurements to a study of the variations in color that may be produced when the lamps and carbons are not maintained in optimal adjustment.

NTS NOW WELDS, REPAIRS ALUMINUM REELS

American ingenuity under pressure has scored another base hit. Repair and rewelding of damaged aluminum film reels, once considered just about impossible, is now a standard service for theatres offered by National Theatre Supply Company.

In this process welding of cracks or breaks in the aluminum—very much more difficult than the welding of other metals—is now routine. Additional material is adding, strengthening the reel at the point of damage. Reels are straightened, without disassembling, in special machines built for this purpose.

TABLE I

Color Measurements at Center of Screen with Complete Optical System; Carbons Positioned to Give Uniform Visual Color over Screen

Trim	Lamp and Optical System*	Amps	ICI Trichromatic Color Coordinates x	y	Color-Temp. at Center of Screen	Color - Temp. Bare Arcs**
12-mm—8-mm SRA	Low-Intensity Lamp and Mirror	30	0.3853	0.3800	3870°K	3570°K
7-mm "Suprex" Pos. 6-mm "Orotip" "C" Neg.	"One K.W." d-c Lamp and Mirror	40	0.3370	0.3584	5300	
7-mm—7-mm "Suprex" Pos.	"One K.W." a-c Lamp and Mirror	52	0.3380	0.3532	5260	
		59	0.3375	0.3560	5300	
		65	0.3346	0.3554	5420	
		42	0.3452	0.3638	5020	5800
7-mm—6-mm "Suprex"	Suprex Lamp and Mirror	45	0.3408	0.3583	5180	
		50	0.3486	0.3660	5060	5950
		56	0.3371	0.3564	5320	6250
8-mm—7-mm "Suprex"	Suprex Lamp and Mirror	60	0.3356	0.3540	5380	
		65	0.3308	0.3515	5570	6400
		65	0.3364	0.3554	5340	
New 8-mm—7-mm "Suprex"	Suprex Lamp and Mirror	70	0.3386	0.3612	5270	
		120	0.3298	0.3502	5620	
13.6-mm H.I. Proj.	High-Intensity Lamp and Condensers	125	0.3302	0.3517	5610	5800
		130	0.3223	0.3560	5480	
		125	0.3283	0.3445	5600	
New 13.6-mm H.I. Proj.	High-Intensity Lamp and Condensers	145	0 3392	0.3576	5240	
13.6-mm Super H.I.	High-Intensity Lamp and Condensers	180	0.3442	0.3599	5050	5480

* All lamp mirrors and condensers were of comparable manufacture by the same maker. The projection lens was 5.5-inch $f/2.5$.
** Values for crater radiation.

The colors of light obtained from a number of commonly used projection arc lamps are accurately compared by measuring the light energy at a number of colors within the visible spectrum. The effect upon color of the optical systems of the lamphouse and projector is also shown, for many of these light sources, by comparison of screen color-temperature with color-temperature of the bare arc.

IA's June Convention To Pass on Proposed Changes in Constitution

OF INTEREST to projectionists everywhere is the program of constitutional changes to be submitted to the delegates of the June convention of the International Alliance of Theatrical and Stage Employes. The program was passed upon by the General Executive Board, which recommended unanimously that the Convention adopt it. Its salient points are reproduced here, by the courtesy of the IA, as a matter of interest to all.

Pledge

The existent sections of the pledge taken by members should be changed to read as follows:

I, the undersigned, as a condition of my membership in the International Alliance of Theatrical Stage Employes and Moving Picture Machine Operators of the United States and Canada, do solemnly pledge myself to accept and abide by the provisions of this Constitution and By-Laws, as now in force and as hereafter legally amended, and hereby express my consent to be governed thereby in the conduct of my trade and in my relationship with the Alliance.

Article Two—Prerequisite for Office (New)

Sec. 6. No person shall be eligible for an elective or appointive office of this Alliance unless he had been a member of this Alliance, in good standing, for not less than five years immediately preceding the date of the convention that nominates him, or the date of his appointment.

Article Three—Quorum (New)

Sec. 7. A majority of the delegates seated at a convention shall constitute a Quorum for the transaction of business, but no action of the convention shall be held invalid for lack of a Quorum, unless the question of the absence of a Quorum was raised before such action was taken. Unless otherwise specified in this Constitution, all decisions of the convention shall be by a majority of the delegates voting.

Article Five—Tenure of Office (New)

Sec. 2. Elected officers shall be elected every two years at a regular convention and shall continue in office until the election and installation of their successors, acceptance of resignation, or removal by impeachment. Appointed officers shall continue in office until removed by the President, or acceptance of resignation.

Article Five—Records Shall Be Delivered to Board of Trustees (New)

Sec. 10. Records shall be delivered to Trustees. All card stubs and official recapitulation sheets shall remain in the possession of the Election Board until after the installation of officers, and shall then be delivered to the Board of Trustees.

Article Five—Eligibility

Article Five, Section 3, is to be changed as follows:

Sec. 3. None but duly accredited delegates to the Convention shall be eligible to election to any office in this Alliance with the exception of those prohibited from acting as local union representatives by reason of their being present in the Convention as members of the General Executive Board and the Board of Trustees of this Alliance.

No delegate or International Officer shall be nominated to office unless attending the Convention unless his written consent to be a candidate shall first be filed with the Registry Clerk of the Election Board.

Seniority

As a result of the change in Article Nineteen, Section 26, "Apprentice Members", it is recommended that our local unions adopt a seniority clause to be placed in the local's Constitution and By-Laws. For the guidance of the local unions a sample clause follows:

Article ———

Seniority shall accrue to the members of this local union from the date of their initiation therein. This seniority shall be for the purpose of acquiring a prior right to employment generally over those members who were initiated subsequent to the member asserting priority. Seniority shall not apply to the filling of any particular position, but only to the securing of employment in any theatre designated by the business agent. It is recognized that there are differences in degrees of skills required by the theatres in which our members are employed. Accordingly, the business agent is empowered, on two weeks' notice, to assign members to different theatres than those in which they have been working, or to remove them from employment altogether to the end that a member asserting seniority may secure employment in a theatre for which he is deemed qualified by the business agent. There shall be established and posted in the office of the Business Agent a Seniority List showing the right of the respective members to employment generally.

Article Five—Convicts Disqualified (New)

3b. Any member previously convicted, sentenced and imprisoned in a penitentiary for a term of more than one year for the commission of a crime anywhere in the United States and Canada shall be disqualified from holding any office in this Alliance. This disqualification shall include all offices regardless of whether they are filled by election, appointment or otherwise.

Article Seven—Power to Appoint

Sec. 2. The International President shall have the authority to appoint an Assistant President, a Manager of the

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SMPE and IA Join Hands to Meet Wartime Problems

The Society of Motion Picture Engineers and the International Alliance of Theatrical and Stage Employes will cooperate actively in the war program for maintaining projection standards under adverse conditions.

The IA will take part in the meeting of the Atlantic Coast section of the SMPE, to be held in New York late in May. President Walsh will either attend or be officially represented — the near conflict of dates between the SMPE meeting and the opening of the IA convention early in June presenting a minor complication.

Detailed recommendations of the SMPE's projection practice committee, anent wartime projection room techniques, will be presented to the joint meeting for discussion from the floor.

The occasion will be unique in U. S. projection history as the first instance in which SMPE and IA have taken official cognizance of each other and officially cooperated in a common project.

Adjustment and Claim Department, an Editor, and as many International Representatives as he may deem necessary, subject to the approval of the General Executive Board. He shall appoint the Election Board at the Convention, subject to the approval of the General Executive Board, as hereinafter provided. He shall appoint delegates to trade assemblages, other than the American Federation of Labor and the Dominion Trades and Labor Congress, in which the Alliance may be entitled to representation, or in which he deems it expedient that the Alliance be represented. He shall exercise such other powers of appointment as are set forth in this Constitution or By-Laws.

Article Seven—Audit of Books

Sec. 8. The International President shall cause to be audited by certified public accountants, to be chosen by him with the consent of the General Executive Board, the books of account of the General Secretary-Treasurer of the Alliance and the books of account of any other person who handles the funds of the Alliance, and shall receive from the said accountant a detailed audit statement dated not later than the last day of the month preceding the opening of the convention. These reports shall be submitted by the President to the assembled delegates for their consideration and action.

Section 16 — Control of Local Unions in Emergency

a. In the event that any affiliated local union of this Alliance shall become delinquent in the fulfillment of its financial obligations to the Alliance as herein set forth, the International President shall, at his discretion, suspend or revoke the charter of such delinquent local union as provided in Article XVIII, Section 11, or

b. Where reliable and creditable information is brought to the knowledge of the International President indicating that a condition exists in an affiliated local union whereby the actions of the officers or members thereof endanger the property rights or interests of this Alliance, of any affiliated local union thereof, or of individual members thereof and where, because of the imminence of irreparable injury thereto, the ordinary procedure prescribed by this Constitution and By-Laws would, in the opinion of the International President, prove too slow, cumbersome, and inadequate to completely protect the rights and interests so endangered; then the International President has the right and is hereby empowered, with the consent of the General Executive Board, to declare the existence of a state of emergency in the said local union. The International President shall give notice of the existence of a state of emergency, in writing, to the officers of said local union, wherein said condition exists. This notice shall be in the form of a complaint and shall be forwarded to the officers of said local union by mail or by telegram. Said notice shall summon the officers of said local union to a hearing before the International President or his duly accredited representative within forty-eight (48) hours at a designated time and place to be mentioned in said notice, and said notice shall contain a statement of facts upon which the International President relied.

At this hearing the officers of said local union shall be entitled to present evidence to the effect that the facts creating the emergency are non-existent or false. During the period of forty-eight (48) hours preceding the hearing, in order to maintain the status quo, the authority of the officials of the local union shall be suspended and all acts pertaining to the local union done on their part during this period shall be null and void.

If, upon hearing, it appears that the facts reported to the International President are as represented, and that a state of emergency does in fact exist, then the International Persident or his duly accredited representative shall have the power during the continuance of said emergency to take over all books, records, monies, credits, and property of such union of every nature whatsoever and to administer the same according to his best judgment for the benefit of such local and this International; to collect dues, fines and other revenue to which said local may be entitled and to incur and pay all just bills and obligations of said local union out of its funds in his hands; to adjust disputes between employers and members of such local union and enter into working contracts for the members which said contracts shall be valid, legal and binding upon said union and the members thereof after the expiration of said emergency until the expiration thereof; and in general, to conduct the affairs of said union in the same manner as it might have conducted its own affairs in the absence of such emergency. The International President, or his duly accredited representative, is hereby expressly authorized and empowered to bring any action at law or equity in any court of competent jurisdiction and in his own name to recover any monies due said local union and any monies or property of said local union wrongfully withheld from him by any officer or other person or the value of any property so wrongfully withheld, together with damages, if any, for the wrongful detention thereof.

Upon the removal by trial, or the resignation of any officer of any local union, the International President, or his duly accredited representative in charge of the affairs of said local union, shall have the power and authority to cause an election to be held by the qualified members of such local union, to choose a successor or successors to such officer or officers, upon the expiration of such emergency as may be determined by the Executive Board as hereinafter provided, and said International President, or his representative, shall have the power and authority to prescribe and enforce such rules and regulations for the conduct of such election as shall insure an honest and fair election by the membership of such local union.

During the continuance of such emergency, all of the rights, powers, and privileges granted to any local union, its officers or members, to conduct its affairs, granted or guaranteed to said local union by its charter, or by this Constitution or any By-Laws enacted hereunder, shall be suspended and any other provisions of this Constitution or the By-Laws enacted hereunder and any provision of the charter, Constitution or By-Laws of any such local union inconsistent with the powers herein granted to the Executive Board of this Alliance, the International President, Vice-President or International Representative appointed to conduct the affairs of such local union are hereby declared to be entirely inoperative and of no force and effect during the continuance of such emergency and until such emergency shall have terminated and such termination shall have been expressed by resolution of the General Executive Board.

The sole authority for the conduct of the affairs of such local union during such emergency shall be the orders, rules, mandates, and decisions of the International President, the Executive Board and the Vice-President or International Representative appointed to conduct the affairs of said local union. provided, however, that any officer or member of such union in good standing shall have the right to appeal from any such order, mandate or decision on account of which he feels aggrieved, to the General Executive Board and from the decision of said Board to the delegates of this Alliance when assembled in convention as provided in the Constitution in case of appeals from decisions of the President.

Article Seven—Books of Local Unions (New)

Sec. 9. The International President shall cause to be audited annually by certified public accountants, to be chosen by him with the consent of the General Executive Board, the books of account of any affiliated local union, and shall receive from said accountants a detailed audit statement annually. These reports shall be submitted by the President to the General Executive Board and to the assembled delegates of each and every convention for their consideration and action.

The cost of this audit shall be paid out of the general fund of this Alliance by the General Secretary-Treasurer.

Article Eleven — Meetings

Sec. 2. The General Executive Board shall meet semi-annually in the mid-Summer and mid-Winter of each year

(*Continued on page* 22)

To The Colors

Arkansas
Local No. 455, Fort Smith
BUFORD SPAULDING
VIC. E. WOODS

California
Local No. 150, Los Angeles
WM. L. ENGLEHARDT
RALPH FLETCHER
LEO GLENN
DONALD S. KOSKOFF
JAY KOSKOFF
C. O. LARSON
D. P. POWERS
ROBERT H. SPRINGER
RALPH OL WELLBAUM
Local No. 165, Hollywood
DONALD W. ARLEN
JAMES FINNEGAN
LAFAYETTE B. HEDE
FRANK KREBS
OTTO LOCKE
Local No. 169, Oakland
JOHN G. PALMER
EUGENE L. PERRY
Local No. 216, Marysville
E. A. WILSON
Local No. 297, San Diego
WM. H. McKINLEY
Local No. 430, Eureka
HOWARD BOBBITT
ALFRED PEYROUNAT
Local No. 564, Modesto
FRANK LETLOW
Local No. 599, Fresno
WM. H. LINGLE
EDW. C. IRVIN
Local No. 605, Visalia
PHILIP NABHAN

Canada
Local No. 105, London, Ont.
WM. S. BRADFORD
ED. T. SUMMERFIELD
Local No. 168, Victoria, B. C.
R. BIASS
COLIN P. McDONALD
Local No. 173, Toronto, Ont.
LOUIS APPLEBAUM
LLOYD COVERT
THEO. F. COVERT
FRED S. JACKSON
W. McCAUL
E. WOODBURN
Local No. 299, Winnipeg, Man.
E. BARR
E. W. FOSTER
M. J. GILMAN
G. M. KRUGER
F. C. PITHART
Local No. 300, Saskatoon, Sask.
FREDERICK PHILLIPS
Local No. 302, Calgary, Alta.
J. R. ANSCHETZ
R. ERIC GORDON
F. D. HIRTLE
BLAKELEY McNEIL
ARTHUR E. SICK
DAVID J. WILSON
L. ADAMS
Local No. 303, Hamilton, Ont.
W. E. CAIRNS
HAROLD HARRISON
Local No. 348, Vancouver, B. C.
STANLEY CREECH
J. R. L. WATCHORN
REGINALD WITT
Local No. 357, Kitchener, Ont.
H. SWARTZENBURG
Local No. 406, Moose Jaw, Sask.
E. B. GARROW
LESLIE W. NELSON
Local No. 528, Kingston, Ont.
JACK QUINN

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GEORGE DeGROSS
Local 277, Bridgeport
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ARTHUR P. FENSORE
HARRY F. KAPLAN
FRANK MATERA
CHARLES PRAKAS
FRANK F. TOTH
Local No. 301, New Britain
FRED PINTO

Delaware
Local No. 473, Wilmington
EDW. R. BOLINSKI
DONALD VARELL
HERMAN WHITE

District of Columbia
Local No. 224, Washington
ROBERT F. BLAKE
LOUIS BERNHARDT
GEORGE BURKE
JAMES W. PAGE
F. L. STEVENS

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WILLIAM A. BROWN
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BERNAL L. SCHOOLEY
Local No. 321, Tampa
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Local No. 412, Bradenton
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Local No. 106, Marion
JAMES FERGUSON
Local No. 133, Hammond
JAMES DUGAN
Local 187, South Bend
JOHN E. WILLIAMS
Local No. 194, Indianapolis
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GEORGE LYDAY
Local No. 539, Anderson
CHAS. R. HARTLEY
Local No. 696, New Castle
GEORGE J. STRONG
JERRY SULLIVAN

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LESLIE ARNDOLD
R. T. SIPOLI
Local No. 540, Baton Rouge
J. W. BEASLEY
Local No. 293, New Orleans
FRED CHATEAU, II

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Local No. 458, Portland
WM. WILKINSON

Maryland
Local No. 181, Baltimore
DREW S. ANDERSON
WM. A. JOHNSON

Massachusetts
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GEORGE HOOKAILO
WALTER KATES
GORDON LYONS, JR.
JOSEPH NUZZOLO, JR.
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LEO R. CADWELL, JR.
Local No. 735, Mt. Clemens
RICHARD RANK
KEN WENNESHEIMER
Local No. 738, Allegan
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HARRY NICKEL
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FORREST CRANDALL

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Local No. 615, Hattiesburg
WILLIAM V. BOATMON
Local No. 674, Biloxi-Gulfport
E. L. SMITH

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WILLIAM F. MATSCHULLAT
H. A. KELLER

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WILLIAM H. JACOBS
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M. MEYER
CLEMENTS MOREL
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S. WERTHEIMER
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Local No. 376, Syracuse
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LOUIS HORKAY, JR.
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BEN O. WRIGHT, JR.
Local No. 551, Shawnee
EARL H. HOLLAND
Local No. 679, Miami
H. R. CALDWELL
H. B. CRESAP

Pennsylvania
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FLORIAN FORNATARO
Local No. 171, Pittsburgh
WILLIAM MARCHEK
JOHN A. PLATT
WILLIAM TATE
JOHN WYCICH
Local No. 283, York
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WILLIAM REEVER, JR.
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CHARLES BALUTES
Local No. 307, Philadelphia
ELLIOTT J. DULLEA
FRANK HOMSHER
HAROLD O. HOGAN
Local No. 516, Chester
DANIEL RESTUCCI
Local No. 628, Charleroi
JOSEPH ROVNY
LOUIS ILLAR, JR.

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WILLARD A. SHOLES
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NOLAN J. LABIT
Local No. 279, Houston
LAURENCE HARDY
Local No. 584, Breckenridge
H. H. ENNIS
K. L. KOFORD
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ROBERT E. SMITH
Local No. 710, Gatesville
HORACE E. BLANTON
THOMAS ELLIOTT
TAD E. GOULD
ROBERT OLDHAM, JR.
GALE WHITE
Local No. 746, Freeport
WM. E. HOGUE

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Local No. 508, Logan
PHILIP O. GLEAVE

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HERMAN H. DIEHL, JR.
Local No. 711, Charlottesville
ROBERT B. BEST

Washington
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BEN NEERLAND
GERARD PETERSON
M. D. RINGER
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EUGENE T. BERTO

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Local No. 164, Milwaukee
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Optical Illusions Producing Three-Dimensional Effects†

By Theodore M. Edison

Nine different optical illusions producing three-dimensional or depth effects are explained and strikingly illustrated. Some of them may be developed eventually into commercially feasible "three dimensional" motion pictures. The astonishing result that can be achieved by turning Fig. 2 upside down stresses the existence of strange optical effects still incompletely explored by the motion picture industry.

SINCE our eyes are primarily natural cameras, recording inverted two-dimensional images only, most of our three-dimensional concepts are gained through indirect processes. Furthermore, a correct interpretation of these processes is not instinctive, but must be taught to the brain by experience. Thus, men, born blind, who receive their sight in later life, cannot immediately correlate the shapes and distances they see with those they have come to know through feeling.

Impressions of depth are gained in many ways, among the most important of which are: (1) comparisons; (2) perspective; (3) the decrease in clarity and color contrast with increased distance (aerial perspective); (4) light and shade, and shadows; (5) the hiding of remote objects by those close at hand; (6) changes in visual relationships between foreground and background objects, due to movements of the observer; (7) the focussing of individual eyes (at close ranges); (8) stereoscopic effects (resulting from the combination of two slightly different views); (9) triangulation (based upon the rate at which the axes of the eyes converge). Of these, perspective, depending upon the use of one eye only, is credited with the most accurate impressions over the widest range of distances.

The remoteness of an object may be estimated when its size is known, and its size may be estimated when its location is known, but when both size and location are uncertain, there is no basis for reliable judgments. For instance, the sun and moon may look much larger near the horizon than they do at the zenith, despite the fact that photographic images show that there should be no appreciable change. (See Fig. 1.)

Sometimes conspicuous objects dominate a scene to such an extent that normal gauges of distance are ignored. The setting sun may appear to be the size of the end of a barrel, even though a tree, silhouetted on the horizon and judged to be twenty-five feet across, may be entirely included within the sun's disk.

It is common knowledge that atmospheric haze causes distant objects to appear less vivid and distinct than those nearer to the observer. There are, however, several more unusual phenomena connecting shading and color with the impression of depth, which are not generally understood.

In the absence of other determining factors, color alone may cause a variation of as much as ten per cent in the estimation of distance. It is probably due to this effect that motion picture titles sometimes seem to stand out in relief when an auxiliary colored floodlight is used to illuminate the screen.

Shading—notably lacking in primitive art—is an important element in life-like pictures. Surfaces may be made to "advance" or "retire," or they may be emphasized or subdued without changing the main outlines of a drawing. Shading is especially useful in bringing out the details of curved contours, many of which can not be represented appropriately in any other way. (A disk may be practically indistinguishable from a sphere when viewed in perfectly diffused light.) Through altered shading, normal photographs may be transformed into good imitation bas-reliefs by placing a positive and negative of the same subject in contact (but slightly out of register) and printing them together.

Illusion by "Brain Logic"

The astonishing ambiguity of Figure 2 is thought to be due, in large part, to the brain's interpretation of shadows[1] and perspective. Definite reversibility is comparatively rare, although duality which does not require the turning of the picture is partly obtainable in several other ways.

Stereoscopic pictures are familiar to almost every one. In them, three dimensional effects become so pronounced that there is a tendency to attribute practically all of our depth impressions to the use of two eyes. However, the stereoscope (Fig. 3) can operate properly only when other factors in the illusion are accurately coordinated.

Reversed relief will be encountered in photographs made with a simple twin lens stereoscopic camera, unless the right and left-hand pictures are cut apart and transposed in mounting. Special methods must be employed to eliminate reversals in the system depicted in Fig. 4.

Reversals in apparent relief are not confined to photographic processes. An

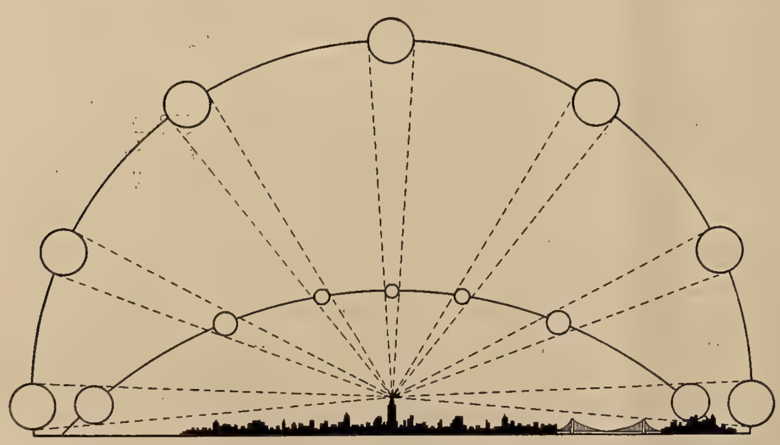


FIGURE 1. *Sun and moon seem larger when near horizon because the mind imagines they are farther away.*

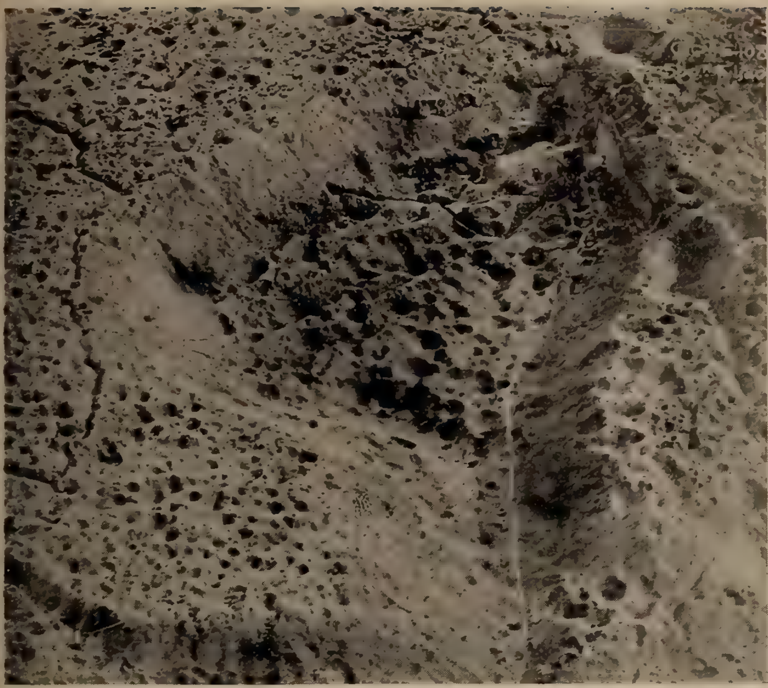


Fig. 2. **"Brain Logic." Turn the page upside down and watch the hollows turn into mounds! Experiments lead to the belief that three factors are essential to this "brain logic" phenomenon: (1) the scene must be *abstract* enough to permit two interpretations; (2) enough *texture* must show to make an observer feel he is *above* ground; (3) there must be a suggestion of perspective lines (and shading). Illusions of this kind sometimes cause confusion in interpreting views seen through microscopes and telescopes.**

"erecting prism" placed before each eye will transform the appearance of physical objects to such an extent that bas-reliefs seem to be intaglios and vice-versa.

Exaggerated stereoscopic effects may be obtained by taking liberties with the location of the "eyes" in making the picture. Thus, although the stereoscope normally aids very little in picturing objects more than two hundred yards away, ground features may be made to stand out in relief in photographs made from an aeroplane at great height if the pictures are taken several hundred feet apart. In war time this method is employed to detect raised camouflaged canopies used by the enemy to conceal their operations.

Grid for Motion Pictures

With practice, it is possible to obtain depth effects from a pair of ordinary stereoscopic pictures, suitably proportioned and mounted side by side, without the aid of a stereoscope, but abnormal eye strain makes the procedure impractical. The principle of a rather successful method of eliminating the stereoscope by combining a special grid with a photographic plate is indicated in Figure 4. A complex modification of this idea may some day make stereoscopic motion pictures[2] commercially feasible.

Color filters have already been used in connection with stage and motion picture productions to carry separate images to right and left eyes from two superimposed or alternating colored stereoscopic pictures projected on a screen. Such startling sensations may be produced in this way, with the aid of exaggeration and sound effects, that members of an audience will try to dodge objects which, to all appearances, are about to be thrust into their eyes! The scheme is appealing as a novelty, and eventually, polarizing screens may eliminate color limitations, but it is tiresome to look through the necessary goggles for extended periods of time.

Mirrors, prisms, and lenses are accessory elements in a host of illusions. An ingenious advertising sign utilizes a semi-transparent mirror and multiple reflections to give an impression of indefinitely great depth. Another device, employing a parabolic reflector or large lens, brings about an apparent materialization of a solid object in free space. Such illusions, in common with mirages and the deceptive displacements of lines of sight which fishermen observe in looking at objects under water, depend on deflections of light rays at points outside of the eye. Any thorough treatment of phenomena of this type would lead too far into the broad field of geometrical optics.

Illusions of Perspective

Perspective illusions outrank all others in effectiveness and importance. Without them, it is almost impossible to convey realistic depth impressions through two-dimensional media. Although they were seldom encountered a few centuries ago, they are now taken for granted to such an extent that we seem to require forceful reminders, such as Figures 5 and 6, to make us realize how greatly figures must be modified in order to *look* natural.

Photographs are so accurate in their perspective and other depth effects and have become so much a part of our daily life that they no longer merely picture what we see—they actually form part of our experience and mold our conceptions of the physical world. For example, running horses are now pictured in attitudes which formerly would have been termed unnatural. Again, artists wishing to indicate great speed often represent racing automobiles as leaning forward slightly, although there are no physical grounds for this distortion. The

(*Continued on page* 18)

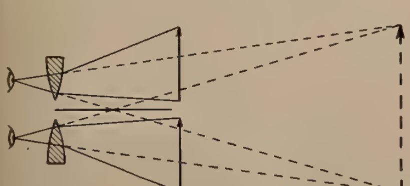


FIGURE 3. ***The stereopticon, a device for producing the illusion of depth in still pictures.***

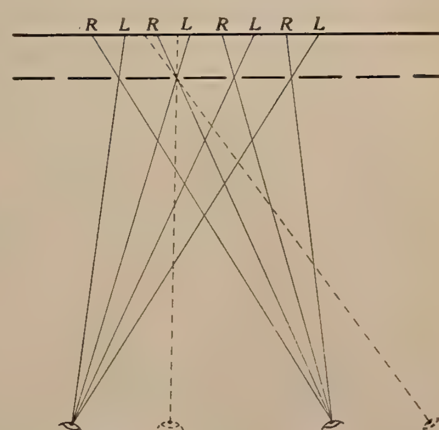


FIGURE 4. ***A possible device for producing the illusion of depth in motion pictures.***

ILLUSIONS FOR THREE DIMENSIONAL EFFECTS

(*Continued from page* 17)

curious association may result from the fact that athletes lean forward when they run, or, more probably, it may be due to a common defect in high speed camera shutters! (When the bottom of a swiftly moving car is photographed a fraction of a second before the top, a leaning picture results — the normal consequence of using a focal-plane shutter.)

It may be extravagant to claim that motion pictures and photography in general could not exist without perspective, but the sudden elimination of perspective from pictures in our modern world would certainly be a calamity for industries dependent upon the use of the camera. In addition to the tremendous primary value of perspective to such industries, there are many secondary ways in which illusions prove useful.

Any one interested in art can well afford to study the numerous optical illusions associated with the gauges of depth just mentioned, as many striking effects may be obtained by making proper use of the surprising relationships between sight and brain interpretations.

The economic importance of "trick" photography increases every year. A motion picture producer may save thousands of dollars on a single scene by using a photographic background instead of sending the actors to a distant country. Here, as well as in cartoon motion pictures of the "Mickey Mouse" type, convincing effects are secured through a knowledge of perspective principles. The problems which arise are especially complex when miniature models appear in conjunction with life-size objects through the use of double exposures.

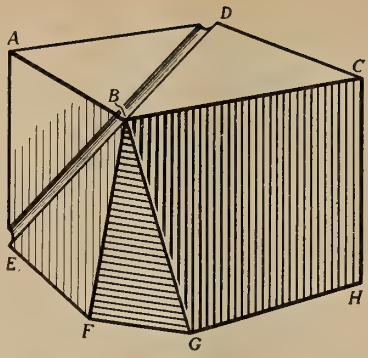


FIGURE 6. ***Angles BEF and BGH are exactly equal, and both right angles!***

Three dimensional motion pictures in which the audience is required to wear some form of spectacles have, of course, long since been proved technically possible. They have never won much commercial acceptance. A recent improvement in which spectacles of Polaroid were substituted for the earlier two-colored eyeglasses still does not eliminate the need for the audience to cooperate by wearing an appliance. The impressive optical illusions here shown, which called for no such cooperation by the reader, may suggest the existence of three-dimensional possibilities still unrealized in motion picture practice.

† Copyright: Calibron Products, Inc.
Calibron Products, Inc., 51 Lakeside Avenue, West Orange, N. J., is an industrial research organization. Their Notebook No. 3, containing the above article and other material dealing with optics can be obtained from the company at 50c per copy; 30c for additional copies in the same package. For the duration, their notebooks will not be sold outside the United States.

[1] The phenomenon was brought to our attention by Professor A. C. Hardy of the Massachusetts Institute of Technology and we are indebted to him and to Lt. Col. J. D. Reardon and Major R. G. Hoyt of the United States Army Air Corps for pictures showing the effect.

[2] See articles by H. E. Ives in the *Journal of the Optical Society of America*, Dec., 1928; Feb., 1929; June, 1930; Oct., 1930; Nov., 1930; Feb., 1931; March, 1931; July, 1931; and in the *Journal of the Society of Motion Picture Engineers*, April, 1932, and Aug., 1933. See also E. E. Draper, U. S. Patent No. 1,930,228.

FIGURE 5. ***The front tire of the truck is actually as high as the dotted elipse at the rear of the picture. Measure it!***

Temperature Rise Conversion Table

Overheating, invaluable advance sign of future trouble, must of course be interpreted in terms of the temperature rise the apparatus is designed to stand. Much equipment is expected to heat up —to a point. Trouble need be expected only when that point is passed.

In practically all cases such apparatus carries a temperature rating on its nameplate. There will be some such information as: "allowable temperature rise" or "working temperature" followed by a figure indicating temperature in degrees.

Where the temperature is given in Fahrenheit (°F.) a simple thermometer with a suitable scale will tell whether the equipment is working within safe limits. But sometimes, especially on motors or other apparatus built for export as well as domestic use, the temperature data is given in degrees Centigrade (°C.). This must be translated into degrees Fahrenheit before an ordinary thermometer can be made useful. The accompanying table will effect the necessary translation.

TEMPERATURE	
°C.	°F.
0	32
5	41
10	50
15	59
20	68
25	77
30	86
35	95
40	104
45	113
50	122
55	131
60	140
65	149
70	158
75	167
80	176
85	185
90	194
95	203
100	212
105	221
110	230
115	239
120	248
125	257
130	266
135	275
140	284
145	293
150	311

PITTSFIELD OPEN

Pittsfield, Mass.—Mayor James Fallon has busted the blue law here by granting permission to the Union theatre to open on Sundays to supply entertainment to defense workers unable to go to the theatres on week days.

Conserving Critical Materials In The Projection Room

RUBBER, copper, aluminum, magnet steel, chlorine, tool steel, magnesium, are among materials commonly used in projection rooms which are now critically scarce. None of them, however, is scarce or particularly expensive in normal times. Routine practices that have grown up over many years do not include extreme precautions to prevent waste of these materials. Such precautions are now in order.

Rubber, of course, is used principally for insulation, sometimes as a cushion against mechanical vibration. It is, as all projectionists know, damaged by oil. Rubber also is injured when subjected to overheating.

More than normal precautions must be used today against getting oil on any rubber article, component or part of a component. This involves, in many projection rooms, greater care in lubricating the projector, also greater attention to oil leakages about the projector and prompt correction of the latter where they exist. That is to say, a little oil seepage which formerly was not regarded as worth any great effort, let alone overtime, to correct, is very much worth correcting now if there is even a small chance that the oil seepage can get to any important item of equipment made of, or containing rubber.

Effects of Overheating

Overheating also harms rubber; this fault is most often encountered in the system amplifiers. Excessive line voltage exaggerates any tendency to this fault. With exposure to prolonged overheating rubber insulation becomes brittle and tends to crack, in some cases giving rise to noisy sound. Rubber used for cushioning tube sockets, as it is in some amplifiers, also becomes brittle, and also in that case tends to give rise to noisy sound, though for mechanical rather than electrical reasons. Amplifiers are often mounted in corners or pockets of the projection room where there is little natural ventilation to hold temperatures down. In some cases there will be true economy in turning a very small electric fan on such an amplifier. Often some small change, such as opening a window, leaving a door ajar, or putting up a small baffle to deflect the air currents of existing ventilating arrangements, will materially reduce operating temperature by the action of just a slight drift of air.

Projectionists are now saving copper by stripping it from carbon stubs. There is likely to be more copper in one burnt out transformer than in many dozen stubs. Avoid burn-outs of any kind by more careful inspection, greater watchfulness for signs of trouble and prompter action in dealing with warning symptoms.

Power Wiring

In many projection rooms the power wiring is not what it should be. From time to time, as apparatus is added, changed or moved about, the power wiring is readjusted and sometimes readjusted so it is about "good enough to get by"—no more. Hence inspection of the power switchboard and its connections will in a very large number of theatres show some lines underfused or overfused, overloaded or unbalanced. Troubles that may arise from such wiring are encouraged by the unsteadiness of line voltage which is now in many parts of the country exaggerated by the unusual demands on power supply systems. It is a highly valuable precaution, under present circumstances, and well worth any overtime that may be needed, to check thoroughly into the projection room's power wiring and correct at once any overloading of power circuits, unbalance in three-wire systems, inadequate grounding, incorrect fusing. And incidentally replenish the projection room's supply of fuses of *every* rating so that when a replacement is needed the right replacement will be at hand, and dangerous substitution of the wrong size fuse will never be necessary.

Aluminum is used in the projection room principally in the amplifier and rectifier condensers. Protect these condensers. One important precaution is built into certain amplifiers in the form of provisions for heating the tubes in advance of operation. This brings the filaments up to full emitting temperature before plate voltage is switched on —hence this voltage is held down, the moment it is applied, by the flow of full current through the tubes. If plate voltage is applied before the filaments reach full emitting temperature, there is not sufficient flow of current through the tubes to act as a "bleeder"—the extreme voltage remains on the plates and may break down the filter condensers. Otherwise protect these condensers by thorough periodic inspection of amplifiers and rectifiers containing them, by prompt attention to any warnings of impending trouble, and by applying indicated corrections without delay.

Similar precautions anent trouble with transformers and choke coils, containing magnet steel, are in order. Loudspeakers also contain magnet steel, and more or less copper. Listen to each loudspeaker unit separately every day. Some theatres are so wired that each unit can be played alone, for more easy check of its condition. Where such wiring does not exist and cannot easily be installed listen at the screen before show time. Switch out of service, pending repairs, any unit that sounds raspy in operation. If you know how to recenter the voice coil of the speaker, do so at the earliest opportunity; if you don't, or haven't the tools or shims, have it done —sending the unit back to the factory if necessary. Don't play a raspy speaker unit. However, before blaming the unit make sure it is really at fault, that the unpleasant sound does not come from some loose and vibrating part about the trumpet, baffle, or their mountings.

Extinguisher Fluid

Chlorine is not scarce but the electricity to obtain it from its sources is— it is obtained by electrolyzing sea water or brine solutions. A new process for obtaining it by burning sulphur has not yet come into general use. It is possible that chlorine may be more plentiful in 1943—meanwhile its use is under rationing even for disinfectants. In the projection room it is the principal ingredient of the fire-extinguishing and cleaning fluid, carbon tetrachloride. Nine-tenths of this fluid, by weight, is chlorine. Don't waste it.

Magnesium finds its chief projection room use in certain types of arc rectifiers. General precautions covering improper operation, excessive overheating, careful inspection and prompt repair apply here as elsewhere.

Projector Parts

Tool and other high-grade steels are important in projector and soundhead mechanisms. Here it is lubrication that is most significant. Avoid excessive wear by correct lubrication, neither too little nor too much. Next in importance is inspection of the film before running it, to avoid breaks, bind-ups or film fires. Open the projection room long enough before the show starts to permit thorough inspection (and repair when necessary) of newly-received film.

Sometimes existing arrangements with

(*Continued on page* 23)

PROJECTION ROOM USES OF TUBE DATA

(*Continued from page 9*)

equipment, is an excellent guide in tracing and preventing trouble. The proper socket voltages being known, all that is needed is a good high resistance voltmeter to find any departure from those readings, and then trace it down in the particular circuit involved—or, if all the readings are off, almost certainly the line voltage is at fault.

Tube data is also invaluable in indicating that one type tube which may be available at moment's notice can or cannot substitute for another which will be delayed in arriving. Note that there is reference in Figure 4 to tube types 6C6 and 57, both of which, according to the graph, show the same performance characteristics as the 6J7. Can any of these substitute for the 6J7? Reference to a tube book or chart will show that the electrical characteristics of the 6C6 are identical with those of the 6J7, except for the first six lines of Table 2, which do not matter greatly in projection work, being principally of importance in radio circuits. But further reference will indicate that the 6C6 does not fit the same type socket as the 6J7, and is somewhat larger in physical dimensions. Hence emergency substitution would require changing the socket, and a preliminary check to make sure there is room in the amplifier for the larger tube. The 57 and the 6C6, on the other hand, fit the same socket, and are the same size, and have (except for internal capacitances that are not of very great importance in audio amplification) the same electrical characteristics. But the 57 has a 2.5 volt, 1-ampere cathode. This tube can be used as a substitute for either of the others only if there is a 2.5 volt, 1 ampere tap on the filament transformer not otherwise employed and capable of supplying its cathode.

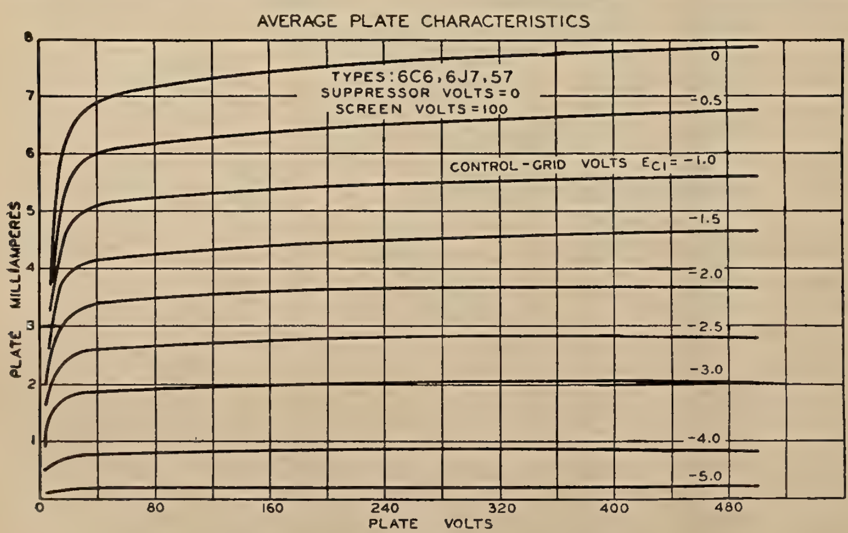


FIGURE 4

Strong Electric Issues Emergency Guide Book and Charts

STRONG Electric Corporation is distributing to all theatres in the United States a 64-page book dealing with wartime emergencies and restrictions in the theatre. Advice for projectionists, managers and all theatre personnel is included in this book; as well as analysis of certain equipment troubles resulting not from apparatus faults but from use of the equipment under new conditions.

For example, the book (called "The Theatreman's Wartime Guide") points out that reduction in arc current, recommended by the government to conserve electric power, results in under-heating of rectifier tube filaments in certain types of arc supply rectifiers, leading to premature tube failures. Unsteady arc operation resulting from the formation of carbide beads at the tips of the carbons, when arc current is reduced, is another new trouble resulting from operation at reduced current, which the book explains, suggesting the appropriate remedy.

Troubles with arc lamp feed controls, difficulties with lamphouse ventilation, maintenance of lamphouse mirrors, and emergency substitutes for arc supply rectifier troubles are other projection room matters taken up and discussed in detail in the Strong book.

In another section, civilian defense as it applies in the theatre is given close attention. CD duties are outlined for every member of the staff—including projectionists, who are said to be responsible for providing incidental music to help calm an excited audience, and have the further responsibility of immediately opening all equipment switches if line power is cut off. This last is to protect the equipment and fuses against damage when the power is restored. Care and use of fire extinguishers is also entered into, with suitable important warnings—for example, that use of the carbon tetrachloride extinguisher, commonly found in projection rooms, is dangerous in the case of incendiary bombs, producing deadly poisonous gas. There is a complete chapter on first aid, including resuscitation in cases of electric shock.

The Strong Corporation is also distributing, with the books, a series of 11" x 14" cardboard posters on the wartime duties of theatremen, in every department of the theatre. One intended for the projection room is planned as a constant reminder of the familiar "ten commandments" of wartime projection, with a few others added. The poster, interestingly illustrated, sets forth twelve specific suggestions as duplicated below.

TAKE CARE

OF YOUR PROJECTION EQUIPMENT

CONSERVE

VITAL MATERIALS

You Can Help Win Our War and Contribute to the Theatre's Charge of Maintaining Public Morale by Observing These Practices:

★ **Keep Projection Rooms and Equipment Clean.**

★ **Lubricate All Equipment Regularly and Properly.**

★ **Make Only Necessary Replacements to Conserve Spare Parts.**

★ **Do Not Burn Carbons Above Rated Current Density.**

★ **Clean Lenses and Reflectors Regularly.**

★ **Service Regularly All Electric Current Distribution Points.**

★ **Allow Sufficient Warming-Up Period for All Vacuum Tubes.**

★ **Inspect, Thread and Rewind Film Carefully.**

★ **Handle Reels and Film Containers with Care . . . . They Cannot Be Replaced.**

★ **Do Not Throw Anything Away . . . . Keep All Worn-Out Parts.**

★ **Rely on Your Equipment Manufacturer for the Solution to Problems Arising from Conditions Imposed by the Use of New Materials.**

'Last Straw' Remedies for Urgent Projector Emergencies

PROJECTOR repairs not ordinarily attempted, because replacement of the worn or damaged part was far more practical, may have to be substituted for replacement, at least temporarily, under the conditions now facing the industry. Projector replacement parts are still available, but deliveries are not always as prompt as in the past, and may become decidedly slow as time goes on.

Rental or loan projectors also will be less easily obtainable. The theatre that owns a third projector, installed or on the shelf, will be least troubled by the new conditions. In others, the projectionist may have to effect some kind of temporary repair, to keep the show going or to prevent worse trouble, pending the arrival of a replacement part which is slow in coming through.

The projectionist may also try repairs of this kind which are inadvisable, and should not be attempted. He will be dealing with a situation new to his experience—new to the industry.

Gears

For example, it may seem that a worn gear can be helped by taking it off its shaft and reversing it, wherever the physical set-up makes that possible. It should not be tried—it will do more harm than good. No gear should ever be reversed, even as a temporary procedure, unless it is possible to reverse the entire gear train. Since that can't be done on any projector, leave the gears alone. Watch them carefully, when wear appears order replacements far enough ahead to be sure of having them in time.

Sprockets, to the contrary, can in some cases be reversed. It is not always an advisable procedure, and never as satisfactory as installing a new sprocket. But where physical arrangements allow, it may help, and protect the film, until replacements are received.

Shafts, to the contrary, are the same as gears—nothing to be done except order new ones in time. There is no practical way of shifting a worn shaft, or of shifting the gear on the shaft, to get away from the effects of wear, even temporarily.

Tension Shoes

Tension shoes can be materially helped in the theatre. They are not expensive; theatre repair is troublesome and takes time; customary procedure has been to install new ones. They are likely to wear unevenly, leaving an edge or ridge of unworn material. This raised edge can be taken off with emery (being sure to clean every fragment of emery away before restoring the shoe to the projector) and then, with the tension readjusted as needed, the shoe will temporary give as good service as when it was new.

Projector gate runners, when worn, can be reversed in some projectors—not in all models.

An emergency shutter can of course be made out of cardboard, if necessary. Sometimes a hole is burnt through a shutter, when by some accident one small area of it is left exposed to the heat of the light beam. This injury can be covered, temporarily, by a patch of any opaque material, provided the shutter is unbalanced.

Gate studs may become wabbly with wear in some projectors. Peening the ends of the flats, which bear against the main frame, will effectively remedy this condition, producing not merely a temporary but a semi-permanent repair.

Proposed IA Constitutional Changes

(*Continued from page* 14)

upon the call of the President, who shall be required to notify, in writing, all members of the Executive Board and all local unions at least fifteen days in advance of the date of such meeting of the time and place of the meeting.

The General Executive Board shall also meet regularly one week prior to the opening of any Convention of the Alliance, in the convention city.

It shall be mandatory upon the President to call such meetings. In addition to these regular meetings the General Executive Board shall convene in special session:

a. Upon the call of the President on such date and at such place as he may designate.

b. Upon the agreement of a majority of members of the General Executive Board, which majority shall determine the date and place of meeting.

Article Seventeen—Section 6, is to be repealed outright.

Article Nineteen—Convicts Disqualified (New)

4a. Any member previously convicted, sentenced and imprisoned in a penitentiary for a term of more than one year for the commission of a crime anywhere in the United States and Canada shall be disqualified from holding any office in any local union of this Alliance, regardless of whether such office is filled by election, appointment or otherwise.

Article Nineteen — Apprentice Members

Sec. 26. No local shall be permitted to register as "Junior" or "Apprentice" more than one for each five Regular members of the local, and in no case shall any local be permitted more than a total of twenty such "Junior" or "Apprentice" members. No local shall be permitted to maintain a "Junior" or "Apprentice" upon its rolls in such status for a period of more than three years. At the expiration of such time such "Apprentice" or "Junior" member shall be balloted upon by the membership of the local union in the manner herein provided, and shall become a full Regular member of this Alliance, or shall cease to have any connection therewith, dependent upon the action of the membership of the local union.

Article Nineteen—Limitation of Initiation Fee (New)

Sec. 28. No local Union of this Alliance shall be allowed to charge an initiation fee in excess of four times the highest regular weekly wage scale which is applicable to the position which will be held by the new member, after his entrance into the membership of the Alliance.

Article Twenty—Emergency

Sec. 7. The procedure in cases where a state of emergency exists in a local union, as defined in Article Seven, Section 16, of this Constitution shall be as set forth therein.

Article Twenty-Two — Authorization to Strike (New)

Sec. 3. In the event that the International President, or his representatives, cannot obtain an amicable adjustment of the controversy, and if in the opinion of the International President a strike would be justified under all the circumstances, he shall be empowered to authorize the affected local union to call such a strike in the manner hereinafter provided. Where, however, the controversy concerns a strike involving the employees of three or more theatres, then the International President cannot call a strike except with the consent of the General Executive Board.

BERNARD HEADS LOCAL 277

Local 277, Bridgeport, has elected Peter Bernard president. Other officers named were Aresto Tomassetti, vice-president; John Martin, financial secretary; James Fensore, business agent and Fred Lewis, treasurer. Executive board consists of John Bernard, Ralph Mauro and the president, vice-president and secretary.

Trustees are Leslie Blakeslee, James Liburdi, Frank Musante, Frank Gorman, Ernest Gilbert, John Lynch, Fred Collins and Ronald McLeod; sergeant-at-arms, Emil J. Valcourt.

Pictures Grossed $1,000,000,000 in 1941; Payrolls Were 322.5 Million

The motion picture industry in the United States, according to the Hays organization, represented in 1941 a capital investment of slightly over two billion dollars, enjoyed domestic grosses of slightly over one billion dollars, and entertained an estimated 85,000,000 Americans every week.

More than 90 percent of the industry's investment was in theatres, which were valued at $1,900,000,000, as against only $125,000,000 in studio properties and $25,000,000 in distribution facilities.

Nearly 17,000 theatres were in operation, with slightly over 2,000 closed. Figures on seating capacity showed the non-operating houses were mostly small ones, averaging 380 seats each, while the capacity of theatres in operation averaged 618. Admission charges averaged 25.2c, with between 75 and 85 percent of all admissions confined to the evening hours between 7:30 and 8:30.

Taxes cost the industry more than payrolls, totalling 410 millions as against 322.5 millions for all payrolls.

Theatre payrolls exceeded those of production studios—160 millions against 139 millions. Theatres, however, had far the larger number of employes: 145,600 to 33,700.

The Hays organization—the Motion Picture Producers and Distributors of America—also presents, in a booklet just published and called Film Facts, a breakdown of an average theatre's operating expenses, which shows that film rental takes 35 percent of the gross receipts, real estate costs 20 percent, payroll 16 percent, with the remaining 29 percent divided as follows: local advertising and publicity, 8%; light, heat and cooling, 8%; interest, profits and dividends, 6%; taxes and insurance, 4%; acts, music, prizes, contests, etc., 3%.

Mail for Navy Men

Even if you know that a sea-going ship is at a certain harbor, don't address mail there, the Navy Department recently requested, explaining that to do so might reveal the ship's position to any person who sees or handles the letter, making it easier for this information to fall into the hands of the enemy.

There are a lot of seamen's families pretty worried about their men out on enemy-infested waters. You can't keep them from being in some danger, but the less the enemy knows, the safer they are.

That's why the Navy Department issued instructions on addressing mail to ships.

CONSERVING MATERIALS

(Continued from page 19)

the management do not permit the projection crew to take the precautions urgently needed at this time because the management does not authorize coming in early or staying overtime, to attend to these matters. In the past, careful balancing of figures may have led some managers to imagine that a small degree of neglect of equipment would be less expensive than paying for the best possible maintenance. Probably it was never true in any theatre. But if it ever was, that time is past.

Local 306 Men Help Show Defense Films

MORE than 75,000 volunteer defense workers in the New York area have seen defense motion pictures exhibited by volunteers from Local 306, MPTOU, and distributed through the New York University Film Library, of which Mrs. Grace F. Gilbert is executive secretary.

The wide use of the films was made possible by a grant from the Alfred P. Sloan Foundation and the volunteer efforts of members of Local 306 of the International Alliance of Theatrical and Stage Employees, the staff of the Film Library and the Film Bureau of the Civilian Defense Volunteer Office.

The 16 films on various aspects of the civilian defense effort and related subjects now in the defense series at the University Film Library will soon be augmented by a new production on the work of a volunteer nurse's aide which was made by members of the Amateur Cinema League under the supervision of the Film Bureau of the CDVO.

Some of the defense films in the library were provided by the Office of Civilian Defense and others were purchased through the Sloan Grant. Several 16mm sound projectors, secured through a pool of machines, were available and members of Local 306 volunteered their services to screen the pictures. About 75 members of the Speakers Bureau of the CDVO were assigned to the Film Bureau, having recently completed a course under Dr. Alice V. Keliher, faculty chairman of the University's Film Library, on the value of films in defense meetings.

Requests for use of the films are made by defense and neighborhood groups of 150 or more persons through the CDVO Film Bureau. Voluntary contributions from the groups are used for maintenance and repair of equipment.

The Films

The most recent addition to the list, "Volunteer Nurses Aide," was filmed by the Amateur Cinema League through the cooperation of the Red Cross, Mt. Sinai Hospital, and the American Theatre Wing, and was supervised by the Film Bureau. It shows recruiting, enrollment, training, and the eventual work of a nurse's aide and is expected to serve as a means of stimulating women to volunteer for the service.

Other films in the collection are:

"Air Raid Warden": The functions of an air raid warden and the need for cooperation by the civilian population.

"Americans All": A plea for the

understanding of South Americans; made by Julien Bryan and issued by the Coordinator of Inter-American Affairs.

"Broomstick Blackout": A silent film showing one simple and inexpensive method of blacking out windows.

"Call for Volunteers": A Canadian film showing how one community, Winnipeg, organized its volunteer service.

"Defense Review No. 1": Three 3-minute stories of an NYA defense job training center, merchant shipbuilding on the Gulf Coast, and subcontracting.

"Defense Review No. 2": Three 3-minute stories of synthetic rubber, construction of new defense airports, and the smelting of aluminum contributed in the campaign last year.

"Fighting the Fire Bomb": Most popular picture in the library, it deals with the construction of fire bombs, how to treat them with sand, water, and extinguishers, and how to deal with the remains of the bomb and safeguard the home.

"Power for Defense": The contribution of TVA in providing power in various war activities.

"Safeguarding Military Information": A morale and anti-sabotage film originally produced for instruction in the Army and now released for civilian use.

"Defense for America": The conversion of American industries from peacetime production to the manufacture of vital war products.

"The Warning": A British film showing the concerted efforts of military and civilian corps during an actual London air raid.

"Women in Defense": Women in science, industry and the voluntary services.

"The World We Want to Live In": An appeal against racial and religious intolerance prepared by the National Conference of Christians and Jews.

"A Few Ounces a Day": The importance of saving waste and contributing salvaged material to the war effort.

"Fire Guard": A British film showing how wardens and fire watchers deal with large numbers of incendiary bombs.

Famous Advertising Film to New York Museum

Finding His Voice, one-reel animated cartoon subject released by Western Electric Company in 1929 to accompany dedication of sound-on-film reproducing equipment in hundreds of theatres throughout the U. S., has been presented to the Film Library of the Museum of Modern Art in New York and finds a place in the institution's archives because of its historic significance in the development of sound motion pictures.

Corny unquestionably, Finding His Voice is an historic film document of indisputable museum interest.

One of the first instructional sound films, the picture outlines the principles of sound-on-film recording and reproduction in ways intended to interest a theatre audience. The characters of this little epic are "Talkie" and "Mutie", personifications respectively of sound and silent films. Talkie takes his dumb friend Mutie to old Dr. Western — meaning the Western Electric Company. The Doc finds Mutie in sad shape, says, "You're running at 60; we'll have to pep you up to 90." (Reference, of course, is to the difference in running speeds of silent and sound film.) Doc proceeds to take Mutie on a whirlwind tour through (quite literally) the various equipment components involved in recording and reproduction, from studio microphone to theatre loudspeaker. Climax comes when Doc equips Mutie with a new voice and he joins Talkie in a close-harmony rendition of "Good Night, Ladies".

COOPER ELECTED TO I.A. OFFICE

Carl G. Cooper of Hollywood has been unanimously elected by the General Executive Board to the office of seventh vice-president, IATSE.

PRINTED IN U. S. A.

INTERNATIONAL

PROJECTIONIST

iP

APRIL 1942

VOLUME 17 • NUMBER 4

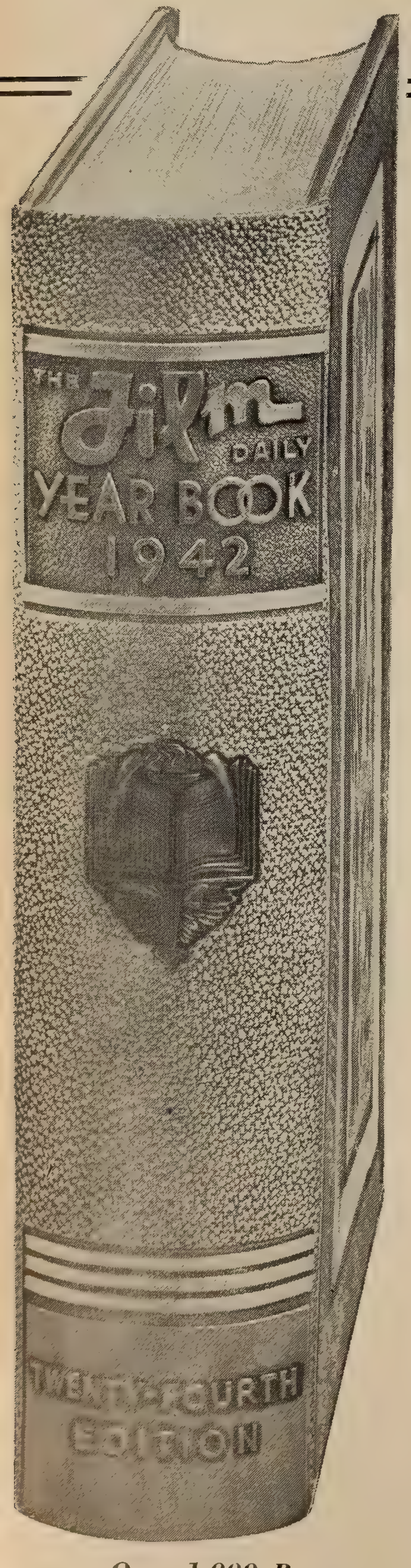
25c A COPY • $2 A YEAR

TO PROJECTIONISTS!

Visitron cells are available for every type of sound projection equipment. Theatre supply dealers can advise the correct cell for your equipment. Buy from your supply dealer. If you wish to have your old cells tested without charge, write to G-M Laboratories, Inc., for instructions for shipping. Information furnished promptly.

It's Big!

The 1942 Film Year Book



Over 1,000 Pages

Exhibitors Praise the 1942 Film Year Book now being distributed

This year you have really done yourself proud by producing an edition of distinction and great merit, and again, in rendering an indispensable service to all exhibitors.
Joseph M. Seider
Prudential Playhouses
New York

The Year Book gives us as complete a record concerning our Industry as anything I know of and we value it very highly. Allow me to congratulate you for this very fine contribution to the Motion Picture Industry.
M. A. Lightman
Malco Theatres, Inc.
Memphis, Tenn.

Personally, I think that any exhibitor who is fortunate enough to have a copy of the 1942 Year Book in his possession should treasure it. I pride in it as much as the average person does a dictionary and refer to it many, many times, and find it very useful for reference purposes to anything pertaining to the industry.
Thomas W. Goldberg
Walbrook, Harford and
Hilton Theatres.
Baltimore, Md.

It is very valuable in our business and is referred to many times during the year. I also wish to congratulate you this year on your beautiful 1942 Edition.
Mort Singer
Mort H. Singer
Theatres Corp.
Chicago, Ill.

We use both the current an year's books many times thi out the year, and look upon as the encyclopedia of the fi dustry.
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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by Aaron Nadell

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Monthly Chat

SHORTAGE of replacement supplies, and possible delays in filling orders for such items, constitute a new trouble in these troubled times. There is some tendency, of course, to stock up while that can still be done. But doing so withdraws critical materials out of use into reserve stock where they are temporarily "hoarded".

IP wonders if pooling of emergency stocks by several theatres in the same community might not provide a practical solution. Perhaps union locals could supply the machinery for that solution.

Naturally, every theatre must keep a minimum of spare parts in its own projection room. No one wants to have to send half a mile for a fuse when a fuse burns out. Naturally, every theatre needs some parts that happen not to fit the machinery of other projection rooms nearby.

But many neighboring theatres are likely to use the same type tubes, still more so the same type exciter lamps, sprockets, fuses or other items.

These might be loaned to a common pool without necessarily stripping any projection room. The theatre that happens to have two intermittent sprockets as spares might contribute one to the pool and keep one on hand. A fresh box of fuses of a given type and rating might be reduced to half a box and the temporary surplus of fuses contributed to the common stock.

Of course there would have to be some bookkeeping; and financial adjustments from time to time as theatres contribute to the pool or draw upon it.

A variation of the pool principle might be a mere record pool, under which each theatre would keep its own spares in its own projection room, but list what it has on hand, and keep the list up to date, so that other theatres would know at once where to send to borrow if they run into trouble.

Of course the question arises of who is to manage and administer such a pool. One theatre might do it for all the others in the community. The local theatre supply company, if there is one, might do it; drawing on their own stock of course but also "borrowing" from a neighboring projection room if their own orders are not filled promptly; and the same holds for the local office—if there is one—of a servicing company. The union local might also do it, adding this contribution to its services to the industry, and to the cooperation which all labor is offering the government.

A. N.

INTERNATIONAL PROJECTIONIST

VOLUME XVII APRIL 1942 NUMBER 4

Reducing Trouble-Shooting to Systematized Procedure

By LEROY CHADBOURNE

THAT all trouble procedures should be systematized is obvious; that this can only be done in advance, when the projectionist is not under pressure, is also obvious. Three simple rules apply in laying out such procedures: (a) look for the trouble where you are most likely to find it; (b) look in the easiest places first, so as not to lose time; (c) follow a logically progressive process of trouble-shooting.

Complications enter the picture when these rules conflict, as for example, the first two. The likeliest place to find a given trouble may be one of the hardest to get at, while a less probable location may be very easily inspected. Here is one reason why common sense procedure will not be followed unless it is either laid out in advance, or else based on such great experience in trouble-shooting as to amount to the same thing.

A decision must be made, as to whether it is better to risk loss of time by searching first in improbable but accessible places, or to be strictly logical and follow the probabilities only. Every such decision must be based on the individual conditions.

This can be emphasized by considering the case of tubes. Let it be assumed that in a given trouble a burnt-out tube is a possible but unlikely cause of the difficulty. In many cases, doubt is ended by a mere glance at the tubes. It would be ridiculous to take an amplifier apart, on mere probabilities, without glancing at the tubes first. But the identical circumstances might occur in equipment using metal tubes, which require either a meter test, or tube substitution and perhaps time out for re-heating, to determine whether a tube is burnt out. There it may be better, under many possible circumstances, to look in more probable places first.

Efficient Elimination

A final complication is introduced into all trouble-shooting plans by the strong desirability of following an effective step-by-step procedure. That is, one investigation should not merely eliminate one possibility, but, so far as can be arranged, a whole group of possibilities. There are usually so many places where a trouble *might* be, that to take them all one at a time might involve intolerable delay. For example, in a case of sound outage in a system having one voltage and one power amplifier, a headphone test at the voice connection between the two will show either sound or no sound at that point. Well, if there is sound there, the voltage amplifier, both soundheads, and all intervening apparatus, are eliminated from further consideration. If there is no sound there, the power amplifier, loudspeakers and loudspeaker power supply if any, are all eliminated as possible trouble causes. Logical step-by-step procedure does not mean starting at the beginning and working tediously toward the other end, but starting as nearly as possible at the middle, and eliminating many steps by one check.

An absolutely ideal trouble process would be one in which every individual step (a) is the easiest and quickest; (b) checks the most probable cause of the trouble and (c) eliminates the largest number of other possibilities. There is no such trouble process—nothing can ever be that perfect. In practice, every planned step involves the sacrifice of one or two of these desirables in favor of a third.

For example, as just said, in a system with one voltage and one power amplifier, a phone check at the voice connection between those amplifiers will eliminate the largest bulk of apparatus by a single test. But surely it's quicker to glance at the tubes—at any rate at the glass ones—and at the panel meters and signal lamps if any. Or the advance plan may specify making the first phone test at the output of the sound changeover simply because, in some particular system, that point is more accessible.

Since there is a logical or best way to hunt for any trouble, but since that best and logical way must be compro-

mised at every step by the details of the equipment involved, in order to arrive at the best practical way, it is obvious that no one is likely to find the best practical way on the spur of the moment and when he is working under tension. That is why trouble work should be mentally planned in advance for every piece of sound and projection equipment, and all wiring. Service inspectors, who spend so much of their business hours actually tracing down troubles of course don't need to do any mental practicing in advance of the next one. Long experience, in their case, gives the same result. Projectionists who spend their business time largely operating, not repairing, equipment, must substitute planning or let their audiences wait till the service inspector arrives.

Rectifier Trouble as Example

As a detailed example of such planning, consider a simple trouble in a very simple piece of equipment—say, a single-phase rectifier, using two tubes, and supplying the projection arc—or, alternatively, a similar rectifier that constitutes part of an amplifier circuit; and in which the trouble is no power output. If this is an arc supply rectifier, there will be no power at the lamphouse, and the rectifier will be inspected to find the cause. If it is an amplifier rectifier, there will be no sound; preliminary tests will have traced the trouble to the amplifier in question and further tests will have shown that the amplifying portions are not receiving plate power.

Let it be further assumed there is no panel meter associated with this particular rectifier, and no signal lamp.

Then the first logical step obviously would be to glance at its tubes, simply because that takes less than a second if the tubes are of glass types. There are just three possibilities—either the tubes are lighted, or they are out, or (in the case of mercury rectifiers) they are lighted but show no blue glow. The possibility that complete loss of power would be accompanied by visible trouble in one tube but not in both is remote.

If the tubes are found not lit, the simplest procedure would likely be to install a new pair, but the safer one might be to check their socket voltage with a voltmeter. However, assume a new pair of tubes is installed. Either the trouble will be cured, or the new tubes won't light, or they will light up and burn out. If the trouble is cured, then of course some voltage surge burned out two tubes at once, and steps should be taken, either by the projectionist or the service inspector, to prevent a repetition. If the new tubes light and burn out, there is a permanent excess of voltage which could hardly have any other cause than the short-circuit of some turns in the primary of the filament transformer, resulting in a higher secondary voltage, or some wiring short-circuit which is putting the plate voltage across the filaments. These may be investigated in the order of which is the more easily checked, and the short cleared or the transformer replaced, as conditions indicate. Lastly, the new tubes may not light at all, and in that case the filament or line fuse (whichever controls) may be checked.

Alternative Test Results

Here again, there are alternatives; the fuse may be out or may be good. If it is good there must be an open circuit between the fuse and the filaments; and the rest of the job is merely looking for that open contact. If the fuse is out and is replaced, either the trouble will be cured or the new fuse won't hold. In the latter event, there must be a short-circuit between the fuse and the filaments.

The two paragraphs preceding assume that a glance at the tubes showed them unlit. But suppose they were lit. Then the circumstances are different, the procedure is different, but the principles of action remain the same. If the tubes are lit, inspect the plate circuit fuses. Either these are good, or are out, or there are none. If they, or it, show failure, make the indicated replacement. The new fuse may hold, the trouble disappear — but of course something caused that fuse to burn out, either overheating, or a voltage surge, or some temporary short-circuit. The trouble-shooting job is not finished until everything possible has been done to run down that cause and prevent its reappearance.

A second possibility is that the new fuse may not hold. The best procedure then probably will be to disconnect the load on the rectifier—that is, the wiring to the lamphouses or that to the other parts of the amplifier, according to the kind of rectifier in question—and re-fuse once more. If the fuse then holds, there is a short-circuit in the load, which must be run down in that part of the equipment; if the fuse still does not hold, there is a short-circuit in the rectifier output that should not be hard to run down.

The two paragraphs above assume a plate-circuit fuse was found burnt out. But it may have been found good, or they may be no such fuse. In that case the plate transformer voltages should be checked, at which point the use of advance planning is further emphasized. Few projection rooms are equipped with multi-scale a.c. voltmeters. Let the reader ask himself what he would do if he had trouble with a rectifier, and in looking for it arrived at the point where it was necessary to check several different a.c. voltages. Use a test-lamp? Suppose it's a sound rectifier and the voltage is too high for a single test lamp. Wire test lamps in series? Well, the audience will have to wait while that is done, and besides, if it's a sound rectifier it may not put out enough current to heat the filaments of lamps in series unless they are pretty small lamps. Let the reader ask himself if *he* has made preparation in advance for this among other trouble possibilities, and if not, how about making such preparation while the audience is *not* waiting.

However, suppose a simple test-lamp check shows no input voltage to the transformer. Then the rectifier switch, or the switchboard fuse supplying the rectifier, are very nearly the only two trouble possibilities. Suppose input voltage is normal, but there is no secondary voltage. Then of course the transformer has gone west and must be replaced. Suppose the secondary voltages are normal. Then, since the tubes are lit, and normal voltage is available for their plates at the transformer, there must be an open circuit between the transformer secondary and the rectifier output.

In the case of mercury vapor tubes which are lit and show no blue glow, the procedure is the same as for any tubes that are lit when there is no output from the rectifier.

Careful Planning

As the above steps were described, one by one, they may have seemed to the reader haphazard, but a re-reading would show that they are not; but carefully planned in accordance with what seemed to be the best possible compromise between the three basic principles of efficient trouble-shooting. It is easily possible that, as concerns some particular rectifier under the reader's charge, these steps are not arranged in the most efficient order of procedure. All rectifiers aren't identical. The reader should arrange his own series, along similar lines, for his own rectifier.

What is basically true of so simple a device as a one-phase rectifier without filters is equally true of a rackful of amplifiers or of a whole projection room. There is, for all equipment and for all troubles, one *most promising* pattern of procedure. The more complex the equipment, the more difficult such a pattern is to work out in advance. But the more difficult it is to work out in advance, the more it is needed in advance, because it will be still more difficult to work out in time of hurry and tension.

It is of course easier not to plan,

(*Continued on page* 22)

New 13.6-mm Carbons For Increased Screen Light†

M. T. JONES, W. W. LOZIER and D. B. JOY

MEMBERS OF THE RESEARCH STAFF, NATIONAL CARBON CO., INC.

A new 13.6-mm super high-intensity carbon designed for 170-ampere operation gives a substantial increase in light over either the old 180-ampere 13.6-mm super carbon or the 125 to 150-ampere new regular 13.6-mm carbon described previously. The new regular and super carbons are compared with the old carbons as to light available on the screen and as to efficiency of light production.

DURING the past several years there have been two types of 13.6-mm carbons available for use in the condenser type of lamp with a rotating positive carbon — the so-called regular carbon ordinarily burned at 125 amperes, and the super carbon burned at 180 amperes. However, the larger motion picture screens could not be lighted to adequate brightness with these carbons and the available optical systems. Recent improvements in carbons and optical systems have radically increased the obtainable screen light intensities. This paper describes a new carbon designed to yield a higher amount of screen light than it is possible to obtain from the other standard projector carbons, and discusses its possibilities for the illumination of large screens.

Employing $f/2.2$ condensers and an $f/2.0$ projection lens having treated surfaces, the 13.6-mm regular carbon at 125 amperes gave approximately 11,500 lumens on the screen with 80 per cent side-to-center distribution and with the shutter not running. With a 90-degree projector shutter and a screen 30 feet in width this would amount to about 10 foot-candles in the center of the screen. For a flat white screen in good condition this is equivalent to a brightness of about 7.5 foot-lamberts, a figure which is below the recommended limits[1] of $10\pm^{4}_{1}$. For these theatres there was available the 13.6-mm super carbon at 180 amperes which gave 30 per cent more light and would therefore increase the foot-candle reading to 13 and the brightness to 10 foot-lamberts at the center of the 30-ft. screen. The fact that this super carbon burns at 25 inches per hour compared to 13 for the regular, and requires 180 amperes instead of 125, limits its application although it has been adopted by a number of the larger theatres and also has been used successfully for rear projection in the motion picture studios.

It has been possible to improve this situation, as described last Spring,[2] through the development of a carbon which gives slightly higher light at 150 amperes than the super at 180 amperes but with a burning rate of only 15 inches per hour instead of 25. It can also be burned at as low a current as 125 amperes and at this current gives the same light as the above-mentioned regular carbon but at a 35 per cent lower consumption rate. This has therefore brought a center brightness of 10 foot-lamberts on a 30-ft. flat white screen within the reach of many theatres which, because of either the high-carbon consumption or the high-arc current, hesitated to adopt the 180-ampere super carbon.

Slow-burning Super Carbon

However, there is an appreciable number of large theatres which have screens of 30 feet or wider where the desire is not for a carbon which will give the same light at a lower current or lower consumption, but for a carbon which will give more light and still be acceptable in respect to current usage and carbon consumption. We have recently

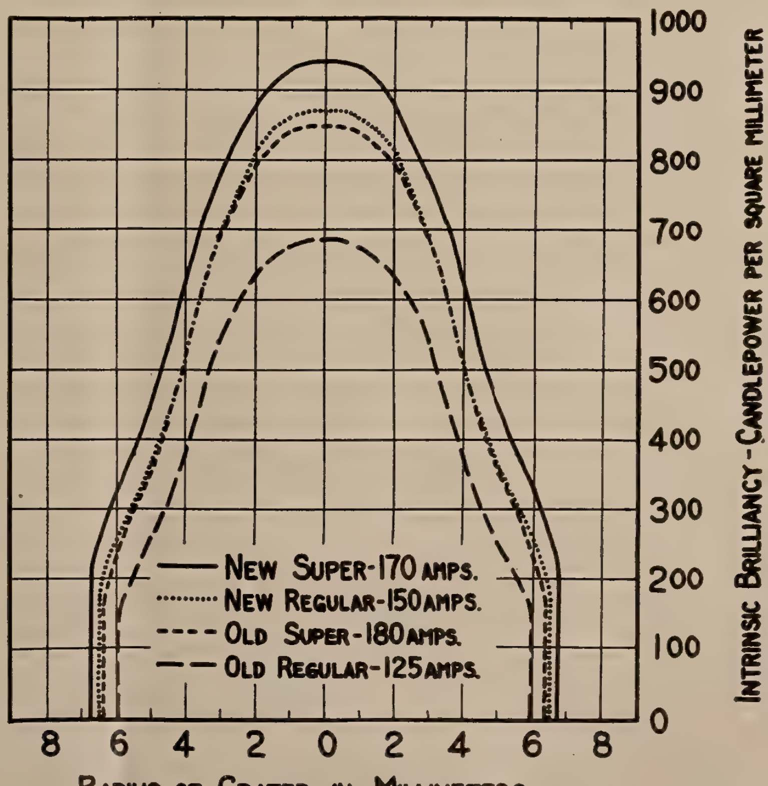


FIGURE 1 (a). *Intrinsic brilliancy distribution across crater of 13.6-mm H. I. carbons.*

† *J. Soc. Mot. Pict. Eng.*

been able to develop such a carbon. This is known as the new super carbon; it can be burned up to 170 amperes, where is has a consumption of 22 inches per hour and, with the same optical system described above, it gives at least 20 per cent more light on the projection screen than the 180-ampere super carbon. This makes available 18.500 lumens without film or shutter, and results in approximately 16 foot-candles or 12 foot-lamberts at the center of a 30-ft. screen, thereby approaching more nearly to the illumination desired by these large theatres. With optical systems using slightly slower condensers and objective lenses, the increase in screen light with this new super carbon is in some cases as much as 35 per cent over that of the old super carbon.

The color of the light on the projection screen is the same with the new super carbon as with the old. The light passing through the aperture, however, has less heating effect per unit of light. Using the same optical system with which the new super carbon gave 20 per cent more light than the old, measurements indicate only about 5 per cent increase in total energy passing through the film aperture.

A comparison of carbon consumption rate, current, arc voltage, and screen light for the four above-mentioned carbons is summarized in Table I. The increase in light with the new carbon is due to the higher and broader intrinsic brilliancy curve as indicated in Fig. 1(*a*). This intrinsic brilliancy curve shows the amount of light emitted in the forward direction per unit area across the crater. For example, assume we are looking directly into the crater as shown in Fig. 1(*b*). From each sq-mm. (about the size of the head of a common pin) of area at the center of the crater of the new

TABLE I

Characteristics of 13.6-Mm H. I. and Super H. I. Projector Carbons under Typical Operating Conditions

Carbon	Old Regular H. I. Projector	Old Super H. I. Projector	New Regular* H. I. Projector[2]	New Super H. I. Projector
Arc amperes	125	180	150	170
Arc volts	68	75	78	75
Positive consumption rate (inches per hour)	13	25	15	22
Crater candlepower	43,000	60,000	63,000	78,000
Screen lumens without film shutter*	11,500	15,000	16,000	18,500

* At 80 per cent side-to-center distribution ratio with $f/2.2$ condenser system and 5-inch $f/2.0$ treated Super Cinephor projection lens.

super carbon, the amount of light coming toward us would be equivalent to that from 940 candles. At this same point on the old type regular carbon we would have the lower intensity of 685 candles. Similarly, near the side of the crater the brilliancy would be 380 candles per sq-mm for the new super and 200 for the old regular carbon. For a given optical system, *i.e.*, condensers and objective lens, the light on the screen, as shown by Cook,[3] should be governed by the intrinsic brilliancy of the carbon plus, to some extent, the width of the high-brilliancy usable portion of the crater. It is thus apparent why the available lumens on the screen for a given optical system and screen distribution are highest for the new super, somewhat lower for the old super and new regular; still lower for the old regular.

(*Continued on page* 21)

Price Ceiling to Govern Theatre Equipment Sales

In the wake of the OPA establishment of a price ceiling, motion picture supply dealers are pricing all equipment items on retail shelves in conformity with prices which prevailed as of March, 1942.

Virtually no equipment item has increased in price since March's outset, and therefore stocks will not have to be marked down to the set ceiling. Some few replacement parts did receive a 10 per cent boost after advent of March, and it was assumed that this rise would be nullified under the Government decree. Theatre equipment has, within the past six months, risen in price some 10 per cent, but this happened before March of this year and so will stand.

Reaction to the price ceiling edict as expressed by dealers was simply that they will gladly abide by both the letter and spirit of the decree.

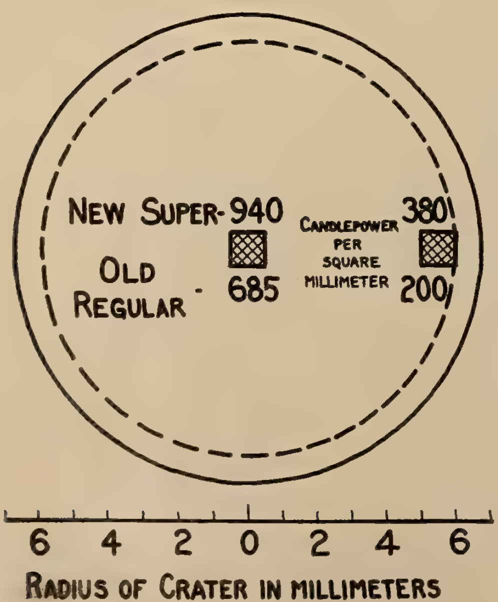
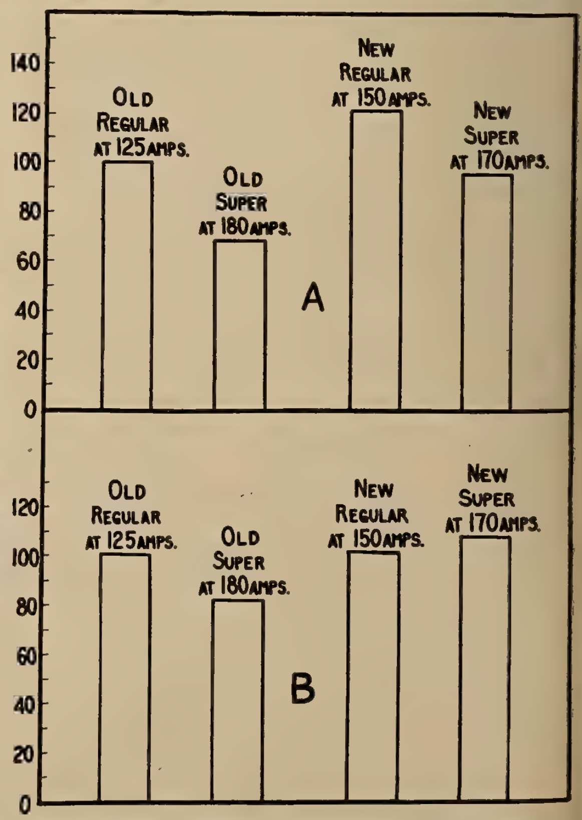


FIGURE 1(b). ***Left—Diagram of crater opening of 13.6-mm old regular and new super H. I. carbons showing brilliancy at center and near edge of crater.***

FIGURE 2. ***Right—Relative quantity of screen light: (A) per inch of carbon; (B) per arc kilowatt-hour.***



sound motion picture equipment for three screening and preview rooms.

The Social Security Board has installed a complete screening system with a number of unusual features to meet their special needs.

Additional contributions towards winning the war are being made by theatre and film recording equipment through many applications associated with more direct military needs. Special methods for the elimination of reflections at glass-air surfaces, as for example, RCA's method for the treatment of theatre lenses, are expected to find a multiplicity of applications in military optical devices where the increased light transmission and image resolving efficiency resulting from the treatment proves valuable, Cahill pointed out.

Theatre Equipment Goes To War

THEATRE and film recording equipments are playing important roles in the war, with contributions involving several spheres of influence and activity of direct importance to the war effort, according to Edward C. Cahill, RCA Manufacturing Company's Motion Picture Division Manager.

Sound motion pictures long ago won recognition by both civil and military authorities as a desirable recreational activity in maintaining morale and providing relaxation. Their value extends also into the fields of group education and training—another area where theatre equipment may be said to have actually gone to war, Cahill said.

"Movies accomplish military training with an economy of time and manpower that is vital," he pointed out. "They make it possible for a single expertly staged operation or example to teach countless groups in exactly the same way. Standardization in military training is necessary for obvious reasons. Movies provide that standardization in many instances.

"In addition, sound motion pictures are providing a visual record of maneuvers and even actual combat with the enemy, so that the action can be reviewed again and again to analyze and illustrate tactics and operations," he said.

Theatre Equipment in the Navy

Although the larger ships use special sound motion picture equipment manufactured to rigid Navy specifications, vessels of the auxiliary class very often employ equipment of the standard "commercial" type. In some instances, portable equipment is necessary to facilitate transfer from one deck of the ship to another. All U. S. Naval training stations are equipped with motion picture theatres for recreation and training purposes.

RCA's Service Division is regularly called upon for technical services when ships come into port, Cahill added. Requests for such services may be received and handled at practically any port by the company's field service organization.

The Navy also employs film recording apparatus of the portable newsreel type (similar to that employed for making "Pathe News" and "The March of Time").

Theatre Equipment in the Army

Almost all Army camps have at least one post theatre, and some have as many as five. Shows are held frequently, almost always playing to "SRO" audiences. Theatres range in size from 800 to 3500 seats and are excellently equipped. The Army Motion Picture Service handled all matters pertaining to purchase, installation and service of the equipment.

The Signal Corps owns and operates most of the sound film recording facilities in Government service. These facilities, currently being expanded sharply, are producing a large number of special films to train the rapidly developing Army.

Variety of Other Applications

Hospital recreation centers located in Army camps throughout the United States and some Insular possessions have been completely equipped with projection room and stage apparatus. These theatres range in size from 150 to 500 seats and are intended primarily for use by hospital and convalescent personnel at the Army posts. Nearly 70 such centers, Cahill reveals, have been supplied by his company with RCA sound systems, Brenkert projectors and lamps, RCA screens, Benwood-Linze rectifiers, and complete projection room accessories.

The Coordinator of Information has taken over the film recording facilities in the Department of Agriculture Building and is supplementing these with additional studio recording facilities as well as with single film recording facilities of the newsreel type. The Coordinator's office has also purchased complete

Equipment Makers Face Labor Shortage; May Use Women

Manufacturers and distributors of theatre equipment may be compelled to use women far more extensively in the past because of the labor shortage resulting from conscription of many of their younger employes, Ray C. Colvin told the semi-annual convention of the Theatre Equipment Dealers Protective Association.

Colvin, who was re-elected managing director, suggested that older men be trained to take draftees' places, and that women be trained in every branch of work they are capable of undertaking.

Conservation of supplies was another important matter under discussion and plans for using equipment more fully in the future were carefully considered.

SMPE Will Endorse IA Program At May 21st Meeting

Record attendance is expected at the meeting of the SMPE's Atlantic Coast Section, set for May 21st at the Hotel Pennsylvania, when the Society and the IATSE will take unprecedented joint action to help keep projection at the highest degree of efficiency under the highly unfavorable conditions resulting from war and priorities. An unusually large number of projectionists will be present, and further stressing the cooperative spirit of the meeting, exhibitors have been invited to attend.

Core of the discussions will be the ten-point conservation program advocated by IA President Richard Walsh, which will be elaborated by the Society's Projection Practice Sub-committee, of which Charles Horstman is chairman. Wholeheartedly accepting and endorsing the program, the committee will discuss in full details ways and means of putting it into practical effect.

President Walsh will be present at the meeting or officially represented. City and government officials are expected to attend.

Henry Anderson of Paramount will follow the discussion of President Walsh's proposals with a paper on "The Defense Program of the Motion Picture Theatre."

Review Of Projection Fundamentals

I.—Kinds of Electric Current

New technical problems will unavoidably be imposed on the projectionist by war conditions. At the same time, he will want to prepare himself for the technical surprises sure to appear when the war ends. In the conviction that our readers will consider the present an ideal time to review their knowledge of fundamentals, IP here presents the first of a series of articles dealing with the bases of electricity, optics, sound and other foundations of projection room technique.

PROJECTION rooms operate with the help of three kinds of electric current—d.c., a.c. and audio-frequency. These are broad classifications, and can be subdivided further. There are, for example, both smooth pulsating d.c. in every projection room; and audio-frequency currents can be sub-divided into low, intermediate and high frequency audio currents. Certain common projection room troubles are the result of the unintended creation of alternating currents of several million cycles.

These currents are all the same thing in spite of their differences, in the sense that they are all electricity. They are electricity behaving in different ways, according to the apparatus involved. They can be converted into one another by suitable apparatus arrangements. The projection room conversion of d.c. into radio-frequency a.c. is an accidental result of certain apparatus faults. The conversion of a.c. into d.c., or of d.c. into audio-frequency a.c., is intentional and necessary.

One of the simplest forms of electricity in the projection room is the a.c. supplied by the power line. This oldest of all forms of a.c. has no special name. It is simply a.c., but to distinguish it from the audio-frequency a.c. used in sound systems it may be called "line a.c." or "the power frequency."

Line A.C.

Line a.c. differs from other forms of a.c. encountered in the projection room chiefly in that it is the current supplied by the power lines. A second distinction is that its frequency is lower than that of most other a.c.; and a third that its wave-form is very regular. These are not very sharp distinctions.

Like all alternating current, line a.c. periodically reverses the direction in which it flows through a given wire. At one moment the current will be moving through the wire from, for example, top to bottom, and the top of the wire will be negative. A moment later the current is flowing from bottom to top, and the bottom of the wire is negative. When the current again changes its direction, and flows from top to bottom again, it has gone through one complete cycle of change. The number of cycles per second is the frequency of the current. A half-cycle, the change from one direction to another, is an alternation; thus a 60-cycle current is one in which there are 120 alternations or changes of direction per second.

Line a.c. over much of the United States is 60-cycle; but 50-cycle is extensively used in the West, and in a few industrial areas 25-cycle power.

But the projection room may also have 60-cycle current identical with line a.c. in every way except that it is not supplied by the power line, but flows in the sound amplifier, and is one of the audio-frequency currents.

Audio-Frequency

Audio-frequency is the term applied to currents associated with the sound equipment. In the same way a sound amplifier is sometimes distinguished from other amplifying apparatus by the term "audio amplifier." Audio frequencies include 60-cycle currents and in the best equipment, 50-cycle currents, although not 25 cycles. Theoretically, the range of audio frequencies those which, if translated into sound by a loudspeaker, can be heard by human ears, extends from 16 to 16,000 cycles. In practice, in today's equipment, the range is from 50 to between 8 and 9 thousand cycles—but post-war apparatus may reasonably be expected to cover the entire theoretical range, as some radio broadcasting now does.

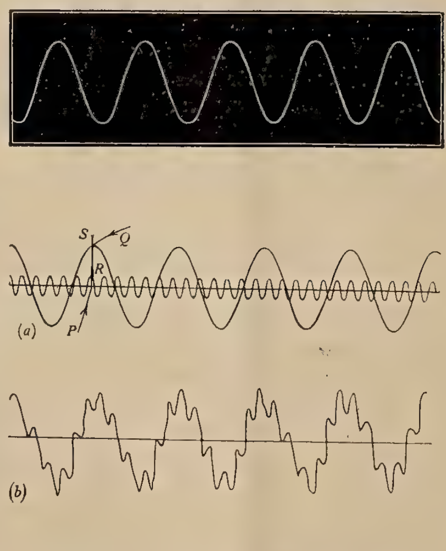


FIGURE 1. *At top, white on black, schematic representation of "pure" alternating current. Below, at "a", two such currents of different frequencies flow in the same wire, producing the complex pattern shown at "b". (The line, SP, denotes one of the instants of time when the lower frequency, Q, and the higher frequency, R, simultaneously reach maximum intensity in the same direction).*

The audio band is generally subdivided into low, intermediate and high frequencies. In today's theatre equipment the "crossover" between low and high audio frequencies is located, as a rule, at or around 400 cycles. Thus, loudspeakers supplied with a.c. of higher than 400 cycles are spoken of as "high frequency" units; yet in testing the equipment, as by a gain run, the term "high frequency" may be confined to currents above 4,000 or 5,000 cycles, or even to those of 7,000 or 8,000. Thus there is no hard and fast rule as to just what constitutes a low frequency or a high frequency within the audio band.

Audio frequencies also differ in practice from line frequency in being far less regular and steady. Whereas a line frequency of 60 cycles is 60 cycles and nothing else, an audio frequency of 60 cycles is almost always accompanied by many other frequencies, the whole forming a complex electrical pattern, which can be reproduced visually with an oscilloscope. Fig. 1. shows the difference between the simple, single-frequency pattern of line a.c. and the complex pattern produced by the interaction of several different alternating currents present simultaneously in one wire. However, "pure" audio-frequencies are encountered occasionally, and produced intentionally for purposes of testing the equipment by test reels, test records, and audio-frequency oscillators.

Audio frequency as encountered in the projection room also differs from line frequency in steadiness of voltage. An a.c. power line is expected to deliver the identical voltage at all times, and approaches this ideal with more or less fidelity; while audio-frequency is expected to vary enormously in voltage in

proportion to the different volumes of the sound which it represents.

Any electrical current is surrounded by invisible electro-magnetic and electro-static fields. In the case of a.c. these fields reverse themselves with every alternation of the current. They can be detected by suitable instruments. Alternating currents of frequencies of 50,000 cycles or higher are surrounded by fields that can be detected at enormously great distances. Such frequencies are therefore used for radio transmission, and are called radio-frequencies.

Like the audio-frequencies, the radio band is commonly thought of as consisting of subdivisions of low, medium and high frequency. But where 10,000 cycles is a very high frequency, when speaking of the audio band as used in theatres, 100,000 cycles is an extremely low frequency when speaking of the radio band. "High" and "low" frequency are terms that have no meaning except as subdivisions within some limited group of frequencies.

Radio-Frequency

Beginning at 50,000 cycles, which is about the lower limit of radio currents, and so nearly below the limit that it is inefficient and seldom used, the radio band extends upward beyond 100,000,000 cycles. Frequencies of alternating current centering around one million cycles (1,000 kilocycles) are used for ordinary broadcasting, and are usually designated neither as "low" or "high" but as "the broadcast band." What might be called "high" frequencies in the radio band begin above 1,500,000 cycles; the "ultra-high" or simply "ultra" frequencies are alternating currents of more than 20,000,000 cycles more or less, and extending upward to frequencies of more than 100,000,000 cycles.

Intermediate frequency within the radio band is a term of very variable meaning. Used in association with broadcasting currents or equipment it may designate a.c. in the vicinity of 400,000 cycles; in connection with higher frequency or short-wave radio, the intermediate frequency may be one of some millions of cycles.

Radio frequencies are generated in the projection room by many types of sparking, as at relay contacts in, for example, an arc feed motor; even in a sparking commutator and sometimes (as a fault) by one or more of the tubes of an amplifier. Radio frequency is present far more often than is generally realized—it is as common as a sparking contact. It causes trouble only in special cases since, being far above the audio range, it cannot operate a loudspeaker or otherwise be heard in the sound.

An electric spark is not a simple flow of current from negative to positive. It is an oscillatory discharge. The voltage piles up until the insulation of the air is ruptured; in the sudden surge of current too many electrons, seemingly, get across the gap, so that a reverse charge is built up, which again punctures the air insulation, repeating the process. In a spark lasting a thousandth of a second, in a d.c. circuit, current will surge to and fro across the air gap perhaps a million times. In short, a spark generates radio frequencies. Connected to an antenna they could radiate to a moderate distance even though small sparks of very low power are their source. With no antenna only the most perfect shielding can keep their fields from radiating a few feet through a projection room.

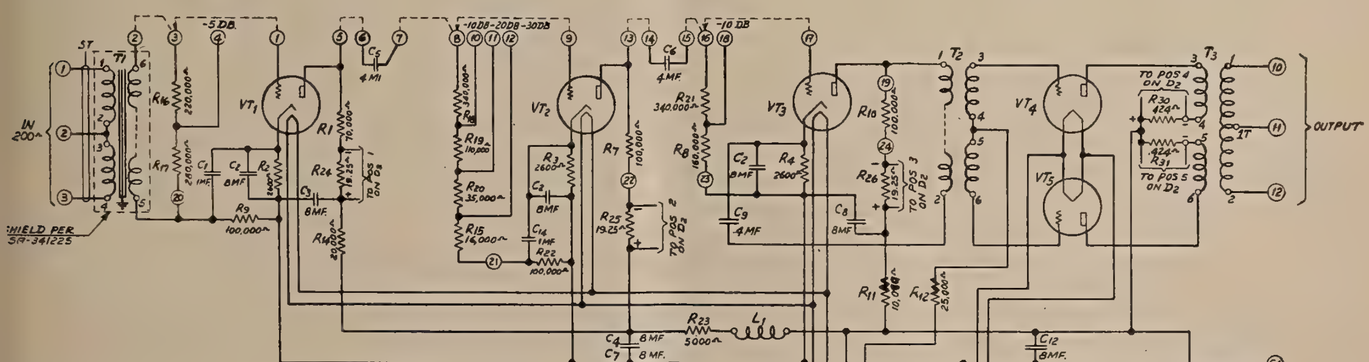
If a thousand such sparks occur in a second's time, the effect will be that of a radio-frequency "modulated" at 1,000 cycles—which last is an audio frequency and within the range of the sound equipment. One of the amplifier tubes may be so wired as to be capable of acting as a "demodulator" or "detector" tube. In that case all the conditions needed for radio transmission of the noise of a spark to the sound system have been established, and that noise will appear in the loudspeakers.

The remedy, as most projectionists know by experience, is to suppress the energy of the spark by absorbing it in condensers. A single condenser wired in parallel to the sparking points helps; better suppression is obtained by a series of two condensers so wired, and with their midpoint grounded.

The unintended generation, in amplifiers, of alternating currents in the audio band and up to and including the radio band is a fault that seldom occurs in practice, but the possibility of it, and the precautions taken against it, explain some of the standard features of amplifier design. In Fig. 2 follow the plate circuit of the third tube from the left downward through R-10, R-26 and R-11. R-11, and condenser C-8 above and to the left of it, are "decoupling" resistor and condenser included in the circuit precisely for the purpose of preventing generation of undesired alternating currents as a harmful by-product of the amplifier's action. Short-circuit R-11 or open-circuit C-8, or do both, and very possibly, this amplifier will give forth no sound except a rich, continuous howl, like a radio set out of adjustment.

D.C.

While 100,000,000 cycles or thereabout represents about the highest frequency used at the present time (unless something new and secret has been developed for military purposes), 25 cycles is just about the lowest a.c. frequency normally



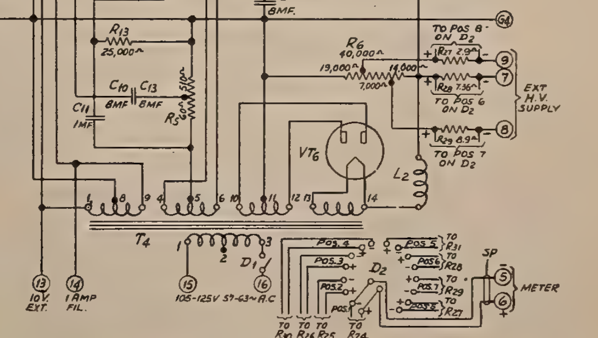


FIGURE 2

used. But of course it is possible to generate a.c. of less than 25 cycles. The current might go through two alternations in its direction of flow once in one second, and thus constitute a current of 1 cycle. Or the two alternations might require 8 seconds, forming a current of $\frac{1}{8}$ cycle. Such currents are not used, but they are possible, and fit without flaw into the general picture of the different ways electricity can behave. The current might require 8 seconds to complete only 1 alternation, and thus constitute a frequency of 1/16 cycle. It is possible to conceive of a current having a frequency so extremely low that the current does not reverse its direction in a year, or in a million years; or, lastly, it may never change direction.

This last would be d.c., which can be regarded as a special form of a.c.—with a frequency of zero. Once established, perfectly pure d.c. continues to flow forever in the same direction, and it does not alter in voltage.

Pulsating D.C.

There is, of course, no perfectly pure d.c. in the sense of an absolutely unvarying voltage. Although ordinary direct currents never reverse their direction of flow, their voltage very often fluctuates to a considerable extent.

Pulsating d.c. can be treated, and is treated, as if it were composed of pure d.c. to which a weaker a.c. component had been added to make it fluctuate in strength. The current in the plate circuit of any amplifier tube is very nearly pure d.c. which is caused to fluctuate in strength by the grid action of the amplifying tube. The fluctuation is extracted from the combined currents by the devices which couple one tube to the next, and passed on as a.c. to the tube following.

In Figure 2, the d.c. of the plate circuit before mentioned, the plate circuit of the VT-3, may be traced from its negative source at the center-tap of the third secondary from the left of the power transformer in the lower right-hand corner. From this tap, numbered 11, trace up to the lower side of C-12, left to the second connection point, up through R-4 to the cathode of VT-3; through VT-3 to its plate and then down through R-10, R-26 and R-11, right as far as possible and down through L-2, left to the filament of VT-6, to whichever plate of that tube is positive at the moment and so back to one end of the transformer secondary.

But the fluctuation imposed on this current by the tube action of VT-3 does not follow the same circuit. Regarding VT-3 as the source of that fluctuation, it may be traced from the cathode of VT-3 to the plate of that tube, and then down R-10 and R-26, but does not continue further through R-11; it has an easier path left through C-8 and R-4 to cathode. A parallel line runs from the plate of VT-3 right to the primary of T-2, down through that primary, left, and up through C-9 to cathode. By virtue of this parallel line the fluctuation imposed on d.c. in VT-3 appears as a.c. in the secondary of transformer T-2.

Conversely, the line a.c. supplied to the primary of transformer T-4, the power transformer of the lower right-hand corner of Figure 2, appears in the output circuits leading from that transformer as d.c., as already traced, in virtue of the rectifying action of tube VT-6, and the filtering action of L-2, C-12, L-1, C-4 and C-7.

D.C. Acting as A.C.

All d.c. acts as a.c. at least twice during its existence; once when it is switched on and again when it is switched off. When switched on, the current rises rapidly from zero to maximum, as if it were one-half of an a.c. alternation—but from there on, instead of declining again toward zero and a reversal of direction, it continues at maximum. Again, when switched off, the current falls away to zero like the second half of an a.c. alternation, but no reversal of direction follows. During these two occasions the d.c. constitutes essentially one-quarter of an a.c. cycle, and if there is an inductance in the line there will be a momentary lag before the current establishes itself at maximum value; and a tendency toward arcing-over at the switch when the circuit is opened.

When a.c. flows through an inductance the value of the current is reduced, independently of the resistance of the wire, by the inductive reactance, according to the formula:

$$I_x = \frac{E}{2\pi fL}$$

in which

L = inductance of the coil in henries
f = frequency of the a.c.
$\pi = 3.14159$
I = current
E = voltage

The similarity of this formula to Ohm's Law for d.c., where $I = E/R$, will be seen at once. Note also that I is designated as I_x as indication that the formula refers only to the effect of the inductive reactance of the circuit. That inductive reactance is usually designated as x, which may be substituted for $2\pi fL$, as a matter of convenience, so that the formula may be written:

$$I_x = \frac{E}{X}$$

So far, no account has been taken of the ordinary resistance of the wire, and the formulas refer only to the effect of the inductive reactance. To find the actual current flowing, the wire resistance must be taken into account, of course. The inductive and resistive effects are combined as follows:

$$I = \frac{E}{\sqrt{R^2 + x^2}}$$

As stated above, x is equal to $2\pi fL$, and its numerical value therefore depends on the a.c. frequency. If the frequency is increased, "f" will represent a larger number, and "x" will be a higher reactance, limiting current flow more drastically. If the frequency is decreased, "f" becomes a smaller number, and the opposition to the flow of current is reduced. Now since d.c. may be regarded as a.c. with a frequency of zero, in the case of d.c. "x" becomes $2\pi L$ multiplied by zero—"f" now being zero. Anything multiplied by zero is of course equal to zero, therefore in the case of d.c. the formula

$$I = \frac{E}{\sqrt{R^2 + x^2}}$$

no longer has any use for x^2 (since that is zero) and becomes only:

$$I = \frac{E}{\sqrt{R^2}}$$

But since $\sqrt{R^2}$ of course is R, the formula for a.c. of zero frequency is simply $I = E/R$.

Ohm's Law for a.c. and d.c. is exactly the same law, except that in d.c. the frequency is zero, and the figures representing the effect of frequency cancel out of the equation.

Somewhat similar considerations apply when the a.c. reactance is capacitative, but the reactance of a condenser, opposite to that of an inductance, increases at lower frequencies, and at zero frequency becomes equivalent to an open switch. The full formula of Ohm's Law for a.c., including the effect of capacitance is written:

$$I = \frac{E}{\sqrt{R^2 + (x_L - x_C)^2}}$$

The formula $\sqrt{R^2 + (x_L - x_C)^2}$ is often designated by the letter Z, the simplified form of Ohm's Law for a.c. thus becoming $I = E/Z$.

TUBE SHORTAGE

Shortage of projection supplies in England has become so acute that tubes are taken out of their sockets each night to be locked up in the manager's office, accordnig to Ideal Kinema, British projection magazine. The managing director of the Snape circuit, which follows this practice, explains in the magazine that "spares today are veritably worth their weight in gold."

Theatre-Size Television Brought Nearer By New Invention

THEATRE-SIZE television has possibly been brought a long step nearer by a revolutionary invention just patented by Dr. Alfred N. Goldsmith.

Dr. Goldsmith, whose well-known contributions to motion picture projection have for many years high-lighted the activities of the S.M.P.E., has developed the details of a television cathode ray tube to operate by heat rather than by fluorescence, with the object of obtaining an image bright enough for satisfactory projection to a theatre screen.

American television methods to date have revolved largely around the method of projecting, by means of lenses or mirrors, the type of image formed in a home-style television receiver. To secure sufficient light for a large screen, voltages have been increased—up to 100,000 volts being used—and the tubes have been made larger than some of those used in home receivers. Light intensities comparable to those of motion picture projection, however, have never been attained, or even approached.

The image—viewed directly or in a mirror in home receivers—and projected to a screen in theatre equipment, was formed on the fluorescent coating of a cathode ray tube. This is a tube in which electrons, emitted by a cathode, are focussed into a sharp-pointed beam by the action of electrically charged vanes, or by magnetic means. The television apparatus acted on the beam to cause its point to swing from side to side and up and down the fluorescent screen, scanning every portion of it in a small fraction of a second. Another part of the apparatus acted on the beam to vary its intensity in accordance with the television signal. Thus different parts of the fluorescent screen were made to glow at different degrees of brightness, producing a picture.

The different portions of the screen glowed in accordance with the changing intensity of the electron beam because the materials used for the screen were of such nature as to emit light when bombarded by electrons.

What Dr. Goldsmith has altered is the screen. Instead of using materials that emit light under electron bombardment, he uses materials—similar to those found in projection carbons or tungsten incandescent lamps—which emit intense light when heated. He pre-heats his screen by an arrangement which amounts basically to backing it with heating coils—although the actual construction is not as simple as that sounds. The screen is pre-heated to just below the temperature at which it will give off light. Bombardment of the screen by the sharp point of the electron beam produces a little additional heat—as every projectionist knows who has observed the plates of his larger amplifier tubes glow red-hot under bombardment by electrons. The additional heat provided by the electron beam in Dr. Goldsmith's cathode ray tube is just enough to raise the screen through the temperature at which it emits light. The degree of temperature rise effected, and the amount of light given off accordingly, depends on the intensity of the electron beam at any given moment, and therefore on details of the television signal.

Dr. Goldsmith's patent, granted April 28, 1942, specifies in great detail arrangements for heating the screen evenly, for preventing the creation of interfering voltage differences as the result of the flow of heating current, for preventing the spreading of heat from small spots of higher temperature to surrounding regions of lower temperature, and devices for controlling and altering the shape of the point of the electron beam to secure greater efficiency in light-production.

W. E. Defense Film Available for Public Showings

"Telephone Arsenal," a new sound film originally produced to dramatize for Western Electric workers the direct relationship between their efforts on the assembly line and military operations involving Western Electric products has been released for public showings. The picture takes its audience into Western Electric's principal plants and distributing houses and shows the manufacture of vital war communications items, shows, too, these same items in the hands of the armed forces—radio equipment for planes, tanks, and torpedo boats, telephone equipment for Army field operations. The role played by the telephone in speeding America's industrial effort, and the operations of the Nassau Smelting and Refining Company, Western Electric subsidiary which plays an important part in the Company's metals conservation program, come in for a share of the footage.

Inquiries about this film should be addressed to Motion Picture Bureau, Western Electric Company, 195 Broadway, New York City.

Union Educational Committees Best Answer To Crisis Problems

WHAT with priorities, uncertain war conditions and the desire to make the best of a bad situation, many leaders in the projection field have come to the conclusion that Educational Committees established by each union local constitute one of the best answers to the trials and tribulations that are sure to come.

Such committees accumulate, pool and distribute information and knowledge that will help prolong the life of equipment and still maintain the highest degree of efficiency in order that the theatre public may still see flawless projection.

Washington, D. C. Local No. 224 was one of the first to recognize the value of such educational activities, and not only maintains a library of technical books for the benefit of its members, but also has set up projection equipment for study. Members have not failed to take advantage of the setup, and the results have been called extremely satisfactory.

While it is of course true in a sense that whenever two or more projectionists get together they are likely to form an "educational committee" for the moment, leaders of the craft feel strongly that current conditions call for definitely organized facilities for exchanging knowledge. Many feel that there should be regularly scheduled meetings of local members to hear lectures by competent speakers and to discuss problems and their answers; that books must be available at local headquarters and members must be willing to swap ideas which will benefit all.

It will be helpful in many ways for all I. A. Locals to appoint an Educational Committee to discuss technical problems in order to be ready for emergencies which may develop through existing conditions. There will be great difficulty in securing new equipment or repairs and replacements and in order to avoid serious difficulties, all projectionists should be encouraged to study, exchange ideas with other projectionists, to read along technical lines, to belong to technical organizations and, most of all, to start educational activities in their Local.

Underwriters Code As It Affects Projection Rooms

Every projectionist knows that his equipment and operations, and any changes he may make in his equipment, must meet the Fire Underwriters' requirements. How many projectionists know what those requirements are in detail? IP will reprint from time to time portions of the National Electrical Code that are important to the projection room, and amendments to the Code as they are issued. Herewith is presented the first installment, consisting of the Underwriters' introduction explaining the purpose, scope and enforcement of the Code, and some of the definitions which will be needed for understanding subsequent installments.

Introduction

PURPOSE and Scope. The purpose of this Code is the practical safeguarding of persons and of buildings and their contents, from electrical hazards arising from the use of electricity for light, heat, power, radio, signalling and for other purposes. It covers the electric conductors and equipment installed within or on public and private buildings and other premises, including yards, carnival and parking lots, and industrial sub-stations; also the conductors that connect the installations to a supply of electricity, and other outside conductors adjacent to the premises.

It does not cover installations in mines, ships, railway cars, automotive equipment, or the installations or equipment employed by a railway, electric or communication utility in the exercise of its function as a utility, and located outdoors or in buildings used exclusively for that purpose.

The provisions of this Code constitute a minimum standard. Compliance therewith and proper maintenance will result in an installation reasonably free from hazard but not necessarily efficient or convenient. This Code is to be regarded neither as a design specification nor an instruction manual for untrained persons. Good service and satisfactory results will often require larger sizes of wire, more branch circuits, and better types of equipment than the minimum which is here specified.

Wiring Layout. It is recommended that architects when drawing plans and specifications make provision for ample raceways for wiring, spaces for equipment, and allowances for future increases in the use of electricity. In laying out an installation for constant-potential systems, provision should be made for distribution centers located in easily accessible places for convenience and safety of operation.

It is elsewhere provided in this Code that the number of wires and circuits confined in a single enclosure be varyingly restricted. It is strongly recommended that architects and others provide similar restrictions wherever practicable, to the end that the effects of break-downs from short-circuits or grounds, even though resulting fire and similar damage is confined to wires, their insulation and enclosures, may not involve entire services to premises nor interruptions of essential and independent services.

Enforcement and Interpretation. This Code is intended to be suitable not only for the use of insurance inspectors but also for mandatory application by governmental bodies exercising legal jurisdiction over electrical installations. The administrative authority supervising such enforcement of the Code will have the responsibility for making interpretations of the rules, for deciding upon the approval of equipment and materials, and for granting the special permission contemplated in a number of the rules.

In order to promote uniformity of interpretation and application of this Code, the Electrical Committee of the National Fire Protection Association has established a formal procedure for rendering interpretations in case of question. Applications for interpretations should be addressed to the Chairman of the Electrical Committee.

It is customary to revise this Code periodically to conform with developments in the art and the results of experience, and the latest edition of the Code should always be used.

With reference to the approval of specific items of equipment and materials contemplated by the Code, it is pointed out that in order to avoid the necessity for repetition of examinations by different examiners, frequently with inadequate facilities for such work, and to avoid the confusion which would result from conflicting reports as to the suitability of devices and materials examined for a given purpose, it is necessary that such examinations should be made under standard conditions, and the record made generally available through promulgation by organizations properly equipped and qualified for experimental testing, inspections of the run of goods at factories, and service-value determination through field inspections.

Fundamental Rules. Throughout the Code are paragraphs which state only fundamentals or objectives of safeguarding. These are followed by paragraphs setting forth the recognized methods and detail by which the purpose and intent of the fundamental may be satisfied. Accordingly, when employed, the rules stating a fundamental only will appear as the first paragraph of an article or section.

Chapter 1. General

Article 100—Definitions

Accessible: (As applied to wiring methods). Not permanently closed in by the structure or finish of the building; capable of being removed without disturbing the building structure or finish. (As applied to equipment). Admitting close approach because not guarded by locked doors, elevation or other effective means. (See also "Readily Accessible.")

Adjustable-Speed Motor: One in which the speed can be varied gradually over a considerable range, but when

Classification of Service	Percentages of Name-Plate Current Rating: 5-Minute Rating	15-Minute Rating	30 & 60-Minute Rating	Continuous Rating
Short-Time Duty				
Operating valves, raising or lowering rolls	110	120	150	...
Intermittent Duty				
Freight and passenger elevators, shop cranes, tool heads, pumps, drawbridges, turntables, etc.	85	85	90	140
Periodic Duty				
Hoists, rolls, ore and coal-handling machines	85	90	95	140
Varying Duty	110	120	150	200

or lower at the discretion of the authorities enforcing the regulations.

once adjusted remains practically unaffected by the load, such as shunt motors designed for a variation of field strength.

Appliance: Appliances are current-consuming equipment, fixed or portable; for example heating, cooking and small motor-operated equipment.

Approved: Acceptable to the authority enforcing this code.

Automatic Door: One which closes automatically by means of a device operated by heat.

Branch Circuit: That portion of a wiring system extending beyond the final overcurrent device protecting the circuit.

A device not approved for branch circuit protection, such as a thermal cutout or motor overload protective device, is not considered as the overcurrent device protecting the circuit.

Building: A structure which stands alone or which is cut off from adjoining structures by unpierced fire walls.

Cabinet: An enclosure designed either for surface or flush mounting, and provided with a frame, matt or trim in which swinging doors are hung. (See cutout box.)

Cable: A stranded conductor (single-conductor cable) or a combination of conductors, insulated from one another (multiple-conductor cable).

Circuit-Breaker: A device designed to open under abnormal conditions a current-carrying circuit without injury to itself. The term as used in this code applies only to automatic type designed to trip on a predetermined overload of current.

Concealed: Rendered inaccessible by the structure or finish of the building. Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them.

Conductor: A wire or cable or other form of metal suitable for carrying current.

Connector, Pressure (Solderless): A pressure connector is a connector in which contact between the conductor and the connector is obtained without the use of solder by means of mechanically applied pressure.

Controller: A device, or group of devices, which serve to govern, in some predetermined manner, electric power delivered to the device governed.

Cutout Box: An enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box proper. (See cabinet.)

D. C. Neutral Grid: A well grounded network of neutral conductors formed by connecting together within a given area all of the neutral conductors of a low-voltage direct-current supply system.

(*Continued on page* 18)

UNDERWRITERS CODE

(Continued from page 17)

Demand Factor: The demand factor of any system or part of a system, is the ratio of the maximum demand of the system, or part of a system, to the total connected load of the system, or of the part of the system under consideration.

Device: A unit of an electrical system which is intended to carry but not consume electrical energy.

Dustproof: So constructed or protected that an accumulation of dust will not interfere with its successful operation.

Dusttight: So constructed that dust will not enter the enclosing case.

Duty:

Continuous: Continuous duty is a requirement of service that demands operation at a substantially constant load for an indefinitely long time.

Intermittent: Intermittent duty is a requirement of service that demands operation for alternate intervals of (1) load and no load; or (2) load and rest; or (3) load, no load and rest.

Periodic: Periodic duty is a type of intermittent duty in which the load conditions are regularly recurrent.

Short-Time: Short-time duty is a requirement of service that demands operation at a substantially constant load for a short and definitely specified time.

Varying: Varying duty is a requirement of service that demands operation at loads, and for intervals of time, both of which may be subject to wide variation.

See table in section 4312 for illustrations of various types of duty.[1]

Electric Sign: A fixed or portable, self-contained electrically illuminated appliance with words or symbols designed to convey information or attract attention.

Equipment: A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like, used as a part of, or in connection with, an electrical installation.

Explosion - Proof: Explosion - proof means enclosed in a case which is capable of withstanding an explosion of a specified gas or vapor which may occur within it, and of preventing the ignition of the specified gas or vapor surrounding the enclosure by sparks, flashes or explosions of the gas or vapor within.

Enclosed: Surrounded by a case which will prevent accidental contact of a person with live parts.

Exposed: Accessible; not concealed.

Externally Operable: (As applied to equipment that is enclosed in a case or cabinet). Capable of being operated without exposing the operator to contact with live parts.

Factory Yard: A plot containing an assemblage of buildings served by an isolated plant, or by a sub-station, or by a master service, and permitting access from building to building within the yard.

Feeder: Any conductors of a wiring system between the service equipment, or the generator switchboard of an isolated plant, and the branch circuit overcurrent device.

Fitting: An accessory such as a locknut, bushing or other part of a wiring system which is intended primarily to perform a mechanical rather than an electrical function.

Garage: A building or portion of a building in which one or more self-propelled vehicles carrying volatile, flammable liquid for fuel or power are kept for use, sale, storage, rental, repair, exhibition or demonstrating purposes, and all that portion of a building which is on or below the floor or floors on which such vehicles are kept and which is not separated therefrom by tight, unpierced fire walls and fire-resistive floors.

Garage, Commercial: A commercial garage shall be considered as any building where self-propelled vehicles are sold or serviced, or where three or more such vehicles are stored or serviced for hire or for commercial use.

Guarded: Covered, shielded, fenced, enclosed or otherwise protected, by means of suitable covers or casings, barriers, rails or screens, mats or platforms, to remove the liability of dangerous contact or approach by persons or objects to a point of danger.

Hazardous Location: Premises, locations, rooms or portions thereof in which (1) highly flammable gases, flammable volatile liquids, mixtures or other highly flammable substances are manufactured or used or are stored in other than original containers; or (2) where combustible dust or flyings are likely to be present in quantities sufficient to produce an explosive or combustible mixture; or (3) where it is impracticable to prevent such combustile dust from collecting in such quantities on or in motors, lamps or other electrical devices that they are likely to become overheated because normal radiation is prevented; or (4) where easily ignitible fibres or materials producing combustile flyings are handled, manufactured, stored or used.

(To be Continued)

[1] Reproduced on page 16.—Ed.

OPA RULE AFFECTS THEATRE SUPPLIES, NOT ADMISSIONS

While theatre admissions and film rentals remain exempt from control of the rigid Government order covering retail and wholesale prices, theatre equipment and supplies are subject to it.

In the "general maximum price regulation," Leon Henderson, Price Administrator, set the highest prices charged as of March, 1942 as an absolute ceiling over virtually everything that Americans eat, wear and use, with few exceptions. Among these exceptions are articles excluded by provisions of the Emergency Price Control Act of 1942, including those that do not fall within the act's definition of a "commodity"; in this group are found motion pictures, theatres and other entertainments.

By its terms, the Act requires that: (1) beginning May 18, retail prices must not exceed the highest levels which each individual seller charged during March 1942: (2) Beginning May 11, manufacturers' and wholesale prices and the prices for wholesale and industrial services must not exceed the highest March levels for each seller: (3) Beginning July 1, no one may charge more for services sold at retail in connection with a commodity than he charged during March, and (4) Effective immediately, all retailers, wholesalers, manufacturers and sellers of services must preserve existing records of sales made during March for maximum pricing purposes when the ceiling goes into effect.

Although theatre equipment and supplies are not specifically mentioned in the Act, they are interpreted as subject to its provisions which apply to prices at all levels—manufacturer, wholesaler and retailer—of every commodity or product, domestic or imported, that is neither covered by a separate OPA regulation nor specifically excluded.

Immediate licensing of all retailers and wholesalers as of the date the ceiling applies is also required by the regulations.

AUSTRALIAN THEATRES CAN'T GET ANY NEW EQUIPMENT

New theatre equipment is practically unobtainable now in Australia, according to George Applegate, manager of Western Electric's interests there. W. E.'s Australian factories are running 24-hours a day, Applegate reports, but are devoting almost all their output to war needs.

NAVY CITES COTTRELL OF ERPI FOR PEARL HARBOR SERVICE

Burdett Packard Cottrell, who has been cited for unusual "diligence and zeal" by the U. S. Navy in his performance of duties in connection with servicing installations of Western Electric equipment aboard naval vessels at Pearl Harbor during and following the Japanese attack on Dec. 7, 1941, joined Erpi in 1929 as an installation engineer, remaining with that organization until 1935 and rising to the post of superintendent of operating planning at company's New York headquarters. Last year he took up his present duties with Western Electric's Specialty Products Division. He is a graduate of the University of Arizona, and has an M.S. degree in Electrical Engineering from M.I.T.

NEW 13.6-mm. CARBONS

(*Continued from page* 10)

Another way of comparing these carbons is by indicating the quantity of screen light produced per unit of carbon and electrical energy consumed. Such a comparison is given in Fig. 2. The old super carbon achieves higher screen light than the old regular at the expense of a 32 per cent decrease in quantity of light per inch of carbon consumed and an 18 per cent decrease in light per arc kilowatt-hour. The new regular carbon at 150 amperes with slightly higher light than the old super at 180 amperes gives approximately 75 per cent more light than the old super for each inch of carbon consumed and is, in fact, about 20 per cent better in this respect than the old regular. The new super with its 20 per cent increase in light over the old super is 40 per cent superior to the old super in quantity of light produced per inch of carbon. Even with its higher light output, the new super produces more light per arc kilowatt-hour than do any of the other carbons. This new super carbon therefore supplies a desirable increase in screen light with improved efficiency of utilization of carbon and power.

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OLD ERPI CONTRACTS PROBED BY SENATE PATENTS COMMITTEE

Foreign agreements respecting by-product patents of the A T & T were brought before the Senate patents committee with the appearance of W. H. Bauer, FCC counsel, who charged the Bell system and the A T & T sought in 1930 to monopolize the communications field through patents.

Bauer presented what he described as "an agreement between Erpi (a Western Electric subsidiary), RCA Photophone and 10 U. S. producers and distributors of motion picture sound films as the American parties and two German distributing companies as the German group."

Bauer asserted the agreement was negotiated in 1930 and that its scope covered the entire world. The FCC counsel further claimed that the U. S. companies "relinquished to the German companies their exclusive rights under patents obtained by the German companies in the U. S. This action on the part of the American companies was a result of the Department of Justice suit against the telephone group and the radio group."

Bauer declared the RCA is in a "very dominating position" in the radio field as a result of its restrictive patent licensing agreement with the companies in Japan, Germany, Italy, Australia, England, France, Hungary, Russia, Holland "and others."

Bauer told the Senate committee that RCA has failed to give sufficient information as requested by the FCC to inform the Commission of RCA's contracts with foreign countries.

IATSE SETS SCHEDULE OF DISTRICT CONVENTIONS

IATSE's schedule of district conven- ·ns to be held in Columbus, O., pre- :n nary to the opening of the Interna- ·nal's biennial conclave there on June will be as follows: District 1 meets lay 29 and 30; district 12, May 30; istricts 2, 4, 7 and 11, May 30 and 31; istricts 3, 5, 6, 8, 9, 10, 14 and 15, lay 31.

CONSERVATION TO BE THEME OF RCA SERVICE MEETING

RCA District Service Managers and home office executives will hold a three-day discussion of present-day theatre service operations in the light of the necessity of conserving motion picture theatre equipment and supplies.

Steps already have been taken to cooperate fully with the industry and with the IATSE 10-point conservation program. Future plans to assist exhibitors in keeping theatres operating under war conditions were covered thoroughly.

The meeting, called to consider detailed conservation plans, will be attended by the following district service managers: J. Mauran, Boston; W. F. Hardman, New York; K. P. Haywood, Philadelphia; C. R. Underhill, Pittsburgh; M. D. Faige, Atlanta; L. R. Yoh, Cleveland; J. P. Ware, Chicago; G. F. Sandore, Kansas City; and I. O. Hill, Dallas. Camden officials to participate in the discussions will include: Edward C. Cahill, Photophone Division Manager; John West, Manager of District Operations; W. L. Jones; F. W. Wentker, Assistant Manager of Photophone Division; Adolph Goodman, Assistant Service Manager; Homer Snook, RCA Theatre Equipment Sales Manager.

DISNEY STUDIO WILL MAKE ARMY TRAINING FILM

A War Department training film on the subject "Identification of U. S. Army Aircraft" will be made in the Disney studios for the Research Council of the Academy of Motion Picture Arts and Sciences. The Council is cooperating with the military authorities. The film will be photographed in animation combined with aerial photography.

SYSTEMATIZING TROUBLE WORK

(*Continued from page* 8)

ut to wait till trouble comes, then uss and fret without preparation, try things at random and *hope* to hit on the right answer before the audience grows too impatient—or merely let the audience wait till the service inspector arrives. The alternative is to do as much planning as possible for everything that can reasonably happen to everything in the projection room. At the best, the trouble will then be found in very short order—whatever its nature; at worst, even if it persists till the service inspector arrives, so many possibilities will have been thoroughly and logically eliminated that the amount of time he will need before getting the show back should be short indeed.

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INTERNATIONAL PROJECTIONIST

MAY 1942

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Monthly Chat

WAR gets things moving. A natural development that jogs along slowly and seems hardly to get anywhere in peacetime, sometimes receives enormous acceleration from a state of war. The last fracas, for instance, took the intelligence tests that psychologists had been developing so slowly, and turned them into a mass production method of measuring the mentality of soldiers. After the armistice, the schools took up those tests on a mass basis. In this war the motion picture is being used for rapid, mass instruction of service men. The armed services find it the most efficient method of instruction available.

Will the schools follow that trend? Will the post-war period see full-scale projection equipment in every classroom, and hundreds of thousands of projectionists needed where tens of thousands are needed now? Wars often do stranger things than that.

• • •

IT HAPPENED in Brooklyn. A worthy member of the craft had a very "off day" indeed. He threaded the wrong reel. Later in the day, he forgot to trim his lamphouse. His partner caught both mistakes just in time. Finally, when he put a reel into the "ready" bin without rewinding it, his long-suffering partner turned to the absent-minded one and said: "You're wasting your time up here. You should be playing ball with the Dodgers."

• • •

SOME projectionists have asked why, if the copper coating of carbons is to be salvaged, the butt ends of the carbons themselves ought not be conserved. The answer is that these carbons are primarily soot, obtained by burning petroleum with a carefully limited supply of air. This soot is then mixed with pitch, derived from Southern pine trees, and baked. Since there will be no shortage of either petroleum or pine trees, there is no need to save carbon butts. The rare earths, that give modern carbons their brilliant white light, are imported, but National Carbon officials say they had the foresight to lay in several years' supply.

• • •

INCIDENTALLY, there is still no definite ruling as to what to do with salvaged copper drippings. Orders to date are to hold them until further notice. Some projection rooms have accumulated many pounds of the now-precious metal; an impressive tribute to the patriotic cooperation of the craft.

A. N.

INTERNATIONAL PROJECTIONIST

VOLUME XVII MAY 1942 NUMBER 5

War Uses of Motion Pictures Discussed at S.M.P.E. Convention

Use of motion pictures by the Army, Navy and for civil defense, new dramatic tricks with sound, technical improvements to follow the war, are disclosed at engineers' gathering.

ADVANCES in every field of motion picture technique were revealed in some fifty technical papers that were read and discussed at the 51st semi-annual convention of the Society of Motion Picture Engineers, held early this month in Hollywood.

Uses of motion pictures in military training were discussed with officers of the Army and Navy taking part. Captain Guy J. Newhard, Chief of the Motion Picture Branch, Technical Data Section of the Air Corps, told the engineers of the numerous uses to which motion pictures are put at the Army's Wright Field, in Ohio. He pointed out that movies are made of tests which are too fast, too complicated, or too remote for accurate observation by the eye. More than 20,000,000 feet of film is being used for that purpose this year, as compared with 1,000,000 feet in 1941.

Capt. Newhard told of an experimental dive bomber which crashed during final tests recently, killing the pilot. Observers were not in agreement as to the cause, but film exposed by an automatic camera in the plane during the flight was recovered from the wreckage. It showed the initial cause and pictured the progress of each successive failure until the plane shattered into the ground.

Movies are used to study bombing, to determine the number and size of bombs most effective against various targets, Newhard explained. Plane undercarriages are tested by dropping the plane vertically from various heights—with the movie camera on hand to record each test. Army maneuvers are covered in detail from the air, as is the laying of smoke screens. Certain types of guns have been improved after study of their firing action as revealed by high-speed motion picture. Cameras mounted in plane cockpits have helped the progress of aviation medicine by recording pilots' reactions to extreme height, rapid descent, and other unusual conditions.

Movies Aid Navy

Lieut. William Exton, Jr., U. S. Naval Reserve, told the delegates of the many uses the Navy makes of movies in training. Pointing out that it is essential that all Navy personnel have the same training in order that standardization be achieved, Lieut. Exton said that the rapidly expanding fleet has made it necessary to spread experienced personnel throughout the entire Navy. He added that training recruits have become more difficult under the circumstances, but that movies have come into wide use to enable one experienced officer to train a larger number of recruits than would be possible by conventional methods. He made the point by declaring that officers, men and ships sometimes had barely time to become acquainted in war time before seeing action.

Theatre Defense Taught by Film

A special film, prepared by Paramount Pictures to teach air-raid precaution and defense measures to the personnel of theatres, was described by Henry Anderson, of Paramount, who pointed to its effectiveness in instructing employes.

Bernard B. Brown, of Universal Pictures, revealed some of the secrets of pre-scoring, the method which enables the artist to be at his best both musically and photogenically—which are ordinarily not always possible at the same time.

"First we record the music without taking the picture, allowing the artist perfect freedom to contort the face to reach high notes and to pronounce the words with perfect clarity," Mr. Brown said. "Then we play the recording back while we take a soundless picture of the same number being sung. The artist is then free to concentrate on his appear-

ance and camera technique while merely going through the motions of singing. The result is better music and better pictures too."

He pointed out that frequently the same technique is employed in making tap-dance sequences. The picture is made without sound, then cut to its final form. The dancers then mount a special sound stage before a screen and, while the picture is unreeled, score in the sounds of their taps. Here again greater freedom to concentrate on one thing at a time produces better pictures, Mr. Brown said.

Tricks Played With Sound

Shakespeare's ghost, jackass and witches were made to sound like the real thing. Bottom, the jackass of "Midsummer Night's Dream," brayed in such a way as to be intelligible. It was all done with special recordings during a lecture on "Recent Developments in Sound Control for the Legitimate Theatre and Opera" delivered by Harold Burris-Meyer, of the Stevens Institute of Technology at Hoboken, N. J.

Mr. Burris-Meyer opened his talk by describing means by which reverberation of sound can be controlled on recordings so that the acoustic properties of any other type building, such as a church, may be reproduced in a theatre. It is done by recording and re-recording the sound at different volume levels fractions of seconds apart. By controlling the volume and time elements, virtually any type of acoustic condition can be reproduced.

He told of literally re-building the voice of an actor to produce a sepulchral voice for the ghost in Shakespeare's "Hamlet." He said it has been found possible to "talk" through thunder in order to produce authentic background for Shakespeare's "Tempest." Skin-creeping sounds of the witches in "Macbeth" have been reproduced by re-building the voices of three actresses so that they themselves could not recognize the sounds. In this case, he said, one voice was raised higher than the human voice can go, one was given a quality which is "a cross between a rockcrusher and a whiskey baritone," and the third was transformed into a basso. He demonstrated by playing a recording of the witches' scene.

He also played a recording of a scene from Eugene O'Neill's "Lazarus Laughed" in which laughter, given a varied instrumentation by electronic means, provides a continuous background to the scene.

Dramatic Sound After the War

Advances in the art of sound recording and reproducing which will have a profound effect on motion pictures when application becomes practicable after the war, were revealed by Edward H. Plumb, of the Music Department of the Walt Disney studios. Plumb pictured almost limitless possibilities for introducing new dramatic qualities and greater realism into motion pictures through the medium of "Fantasound," the new sound recording and reproducing method developed for "Fantasia" by RCA and the Disney studios.

Emphasizing that "Fantasia" was an experiment, Plumb declared that it paved the way for many advances in the art, showing how dialogue, music and sound-effects may be combined with new effectiveness.

The RCA-Disney-developed system employs a number of sound pickups to record, and a number of loudspeakers located behind the movie screen, to the right and left, and about the theatre walls, to reproduce sound. In "Fantasia" the illusion of sound moving on and off the screen was produced by this means.

Plumb pointed out that adaptations of the system can be used to reproduce dialogue, music and sound-effects simultaneously—the former coming from behind the screen, and music coming from off-stage, and the latter reaching the audience from the walls of the theatre.

"In ordinary reproduction one of these three mediums must, with rare exceptions, be dominant while the other two are sacrificed," Mr. Plumb said. "In 'Fantasound' it is possible to follow the continuity of the dialogue clearly and still receive the full impact of the music, or the dramatic realism of atmospheric sound effects. These tools may not be available in the theatre for the duration, but this might be an excellent period during which to develop a practical, effective plan for using them."

Actual theatre experiences with "Fantasound" were described to the engineers by W. Jones, of the RCA Manufacturing Company, and W. E. Garity, of the Disney studios.

Television Subjects Discussed

Facilities for adapting motion pictures to television transmission were demonstrated at the Paramount studios. Equipment developed by Television Production, Inc., a Paramount affiliate, to permit the projection of movies into the home via radio waves was used, and described by officials as part of the emphasis placed on television during the convention.

Ten years of research in the development of suitable view-finders for television cameras was recounted by G. L. Beers, of the RCA Laboratories. He pointed out the difficulties of focusing and directing television cameras as compared with motion picture or ordinary cameras, and told of technical developments worked out to overcome them.

H. R. Lubcke, of the Don Lee Broadcasting System, reviewed the engineering aspects of portable television pick-up and camera equipment.

Dr. B. Gasper described "The Gasper-color Process" he devised to produce colorfilms. His technical talk was followed by another by Dr. Alexander Goetz and F. W. Brown, of the California Institute of Technology, on the effect of graininess in photographic emulsions in scattering light in film.

Soviet Progress in Films Told

The technical progress of the motion picture art in Russia was reviewed by G. L. Irsky, of the Amtorg Trading Corp., war-time representative of the Soviet Union in New York City, who is chief engineer of the motion picture industry in Russia.

He declared that, while all industry is young in Russia, the motion picture is the youngest, and has not yet reached the high standards of the art in the United States. Progress in the last 10 years has been remarkable, he added, with factories today producing equipment, film and accessories for studios and theatres. Many studios have been rebuilt and adapted for sound movies.

Irsky said that 80 percent of Russian films are translated into from 30 to 40 national languages before being released for showing throughout the vast expanse of the country. There are 40.000 motion picture theatres in Russia, some showing colorfilm as well as black-and-white. A special theatre has been erected in Moscow to show three-dimensional movies, he said.

Development of a new type of test instrument which eases the burden of the theatre sound engineer in servicing the sound reproducing systems used in modern movie houses was told by Adolph Goodman, of the RCA Service Division. It was pointed out that the instrument, described as an audio chanalyst, makes it possible to detect faults in sound systems by sending a signal through the system to the point of trouble in order to locate it.

PITTSBURGH LOCAL ELECTS

The Pittsburgh local No. 171, IATSE, has elected Paul Ferry as president. George Engster was elected vice-president, Luther Thompson, secretary-treasurer, and Roy Grove, business agent.

David Thomas, Martin Torreano and Irwin Turner were elected members of the executive board and James Clair, Henry Link, Sr., and Arthur Williams were named trustees. Donald Ackard was chosen delegate to the Pittsburgh Central Labor Union and Engster, Grove, Luther Thompson and William Thompson were named delegates to the IA Columbus convention.

Maintenance and Repair of Loudspeakers

By LEROY CHADBOURNE

LOUDSPEAKERS are as much a part of the sound system as any other item, but being outside the projection room they commonly receive less attention than any other, except in those few houses where stage electricians look after them.

Fortunately, speakers nowadays give little trouble, but they are still by no means immune to failure or to faults of various kinds. In addition to being out of the projection room, however, speakers are also characterized by the fact several of them may be doing the same thing simultaneously, hence a fault in one tends to be masked by successful performance of its neighbors. Periodic, careful check should be made by listening in all parts of the auditorium, or by operating the units one at a time. Where neither is done, some portion of the audience may suffer poor sound. Some types of speaker troubles tend to grow worse unless corrected, but without more careful check than is made in many theatres, they usually are not discovered promptly.

Existing supply conditions, involving delays in the shipment of replacements, emphasize the importance of catching speaker troubles promptly. They also will probably require more elaborate theatre repairs than the simple process of putting in a new unit, which has been the practice very largely followed up to now. When there is going to be serious delay in obtaining a new unit, theatre repair of the one on hand, if at all possible, is obviously indicated.

Speaker troubles fall into three general classes: no sound, distorted sound, weak sound. Distorted sound, when due to certain causes, is likely to be followed by no sound at all unless repairs are made quickly.

The simplest form of loudspeaker, and one widely used in theatres today, consists of a permanent magnet, a diaphragm, and a coil of wire called the voice coil, mounted on that diaphragm. Even more common is the type in which the permanent magnet is replaced by an electro-magnet, consisting of a coil of wire wound around an iron core.

The loudspeaker is one place in the sound system where a great deal of sound power can be wasted. There are speakers that have efficiencies as low as five percent—that is, they waste 95 percent of the voice power supplied to them. To secure maximum efficiency in theatre speakers, and prevent as much waste as possible, it is customary to construct them so that the voice coil is actually in, not merely near, the magnetic field,—that is, to locate the coil at a point of maximum flux strength. This means leaving a gap in the core of the magnet, in which the voice coil moves. But an air gap in a magnetic core reduces the efficiency of the magnet; hence this gap or slot is often made just barely wide enough for the coil; further, the coil is sometimes made of metal ribbon wound edgewise, instead of wire, to permit the use of a still narrower slot.

It is obvious that a very slight physical displacement of the coil will cause it to rub against the side of the slot, in speakers of this construction. And since the coil is constantly vibrating—that is its work—it is likely to become somewhat displaced in course of time. If the coil touches the sides of the slot it moves in, sound quality will be distorted. If the condition is not corrected promptly by re-centering the coil, it can be expected to damage itself to the point of open-circuiting, after which the unit will give no sound.

Adjusting Voice Coil

In the type of loudspeaker commonly used for low-frequency reproduction, the coil is accessible as soon as the speaker is removed from the baffle. It is held in proper position by some mounting device, usually a single screw. When this is loosened, finger-tip touch will shift the position of the coil. It can be re-centered, and the screw again locked down. To center the voice coil accurately, shims are used; but a satisfactory emergency job can be done by sense of touch alone. It is desirable to re-tighten the holding screw by degrees, at each stage of the process moving the coil in and out along its slot by pressing gently near the center of the diaphragm with the tips of the fingers. The slightest sense that the coil is binding, or touching anything, as it is moved, means it is still not properly centered.

A final finger-tip test is made after the holding screw has been finally and very firmly tightened. Not until that test is satisfactory should power be turned on.

The type of speaker used for high-frequency reproduction is almost always so constructed that an outer shell has to be removed to get at the voice coil mounting and centering devices; and the method of centering the coil is commonly more elaborate than in the case of the low-frequency unit. However, there will be nothing puzzling or difficult about any of these units, and with many of them theatre repairs can be made provided the voice coil is intact and still firmly cemented to its diaphragm.

Diaphragm Replacement

Where the voice coil has been damaged, a new coil-diaphragm combination can be ordered, in place of an entire speaker, and mounted in the existing unit. This may prove necessary in cases where voice coil-diaphragm delivery can be made more promptly than delivery of an entire unit.

Permament magnet speakers are a bit more awkward to work on than others, because of the extremely powerful magnetic field, which will take the screwdriver out of a man's hand if he holds it loosely, and sometimes interferes with loosening or setting the holding screws.

Some units are constructed with such very delicate clearances that theatre repair, as against factory repair, is highly undesirable, and should be attempted only in emergencies when a replacement unit simply can't be obtained in reasonable time. Others can be repaired by the projectionist without too great difficulty.

It is very important to remember that a displaced voice coil is not the only condition that can cause a loudspeaker to distort, and when such distortion is heard it should not automatically be assumed that the voice coil is displaced. The trouble may have nothing at all to do with the loudspeaker unit. It may

be the result of vibration of a loose part in the baffle, or the baffle may be loosely mounted, or the unit may be loosely mounted on the baffle. Further, resonant vibration of cables on which speakers and baffles are hung may be responsible for the effect, and in occasional instances such trouble has been traced to a loosened part in an auditorium lighting fixture.

When a loudspeaker unit apparently delivers distorted sound, listen carefully to determine that the distortion is really coming from the speaker, and not from some nearby object which may be vibrating in resonance; check the tightness of the mounting of the unit and of the baffle, examine the baffle or trumpet for any loose or broken parts. But the need for these checks does not mean that the distortion should be permitted to continue a moment longer than necessary. If it does come from the voice coil, every additional second that speaker unit is kept in use increases the chance that the voice coil will open-circuit through friction with its slot.

Distorted sound also is produced by a damaged diaphragm, meaning one that has become physically dented or torn. Where this condition occurs, retaining the unit in service is not usually likely to lead to complete sound outage, but the distortion will continue until the condition is remedied by installing a new voice coil-diaphragm combination, either in the theatre or at the factory.

Complete loss of sound at the speaker has two general causes, of which open circuit of the voice coil is most common. Open circuit of the power supply to the field circuit (in speakers that are not of the permanent magnet type) is the other, and this may result from outage of a fuse or any failure in the rectifier that supplies the speaker field. Open or short circuit of the speech line to the loudspeakers is seldom encountered.

Low volume of sound is seldom found associated with only a single speaker unit. Usually sound from all units is low, and is caused by low current output of the field supply rectifier. Sound volume in the auditorium is also materially reduced when the screen is not cleaned often enough, thus allowing the perforations to become clogged with dust. This condition of course is disadvantageous to the brightness of the screen image, but in addition it leads to raising the volume unnecessarily, straining both the speakers and other portions of the sound system.

In any work that is done on loudspeakers, even if it amounts to no more than changing a unit, it is very necessary to remember the importance of poling or phasing the supply leads. If wires are reversed, one unit will work 180° out of phase with its neighbors, producing "dead spots" in the auditorium. Don't trust to memory when disconnecting loudspeaker leads. The binding posts on the speaker itself are, in almost every make and model, marked, numbered, colored or otherwise individually identified. If they are not so marked, mark them. Then, unless the wires are color-coded to match the color-coding of the speaker terminals, tag each wire before disconnecting it. Very often, you will find they have already been tagged. If not, use common price tags of small size—they can be bought in any stationery store. A dime's worth will last the average theatre ten years; they should be part of the regular repair equipment of every projection room.

Rear Admiral W. C. Watts, U. S. Navy retired, presents to Robert Shannon, President of the RCA Manufacturing Company, the all-Navy "E" flag awarded for "excellence" in production of Navy material.

UNEMPLOYMENT INSURANCE RULINGS IN NEW YORK STATE

The New York State Division of Unemployment Insurance has issued additional rulings concerning the definition of "refusal of employment." Such refusal bars the person concerned from unemployment insurance benefits. Some of the Division's interpretations follow:

Refusal of suitable employment because a job held no future is not a justifiable reason within meaning of the Law.

Desire to obtain higher wages and more advanced work does not justify refusal of a job for which claimant is fitted by training and experience, and which pays prevailing wages commensurate with those previously received by claimant.

A claimant is not to be excused for refusing a job in his usual occupation because he prefers another occupation in which he has had no prior experience or training.

Refusal of referral to a job because claimant felt she could get a better job is not an excusable refusal.

A claimant with long experience in a regular occupation may not be penalized for refusing a job in another occupation in which he attempted unsuccessfully to earn a living during period of unemployment.

Preference for another occupation is not a justifiable reason for claimant's refusal of suitable employment in his usual occupation.

Undue delay in acceptance of offer of suitable employment to allow claimant to "shop around" for another job renders claimant subject to disqualification.

A claimant who has refused to accept an offer of suitable employment is disqualified from receiving benefits for the duration of the period of unemployment following the refusal.

Where traveling distance is not excessive, a claimant's excuse of personal inconvenience is not sufficient to justify refusal of suitable employment.

The excuse from an experienced person that, in his own opinion, he was not qualified for a job offered in his usual occupation is not acceptable where he did not interview prospective employer.

U.S. May Close Many Theatres, I.A. Warns

IF projectionists do not conserve critical materials out of patriotic motives, the government will force conservation by closing down some theatres in each community. This was the blunt warning of IA President Richard Walsh, delivered through International Representative Joseph D. Basson to the May 21st meeting of the Atlantic Coast section of the Society of Motion Picture Engineers. Mr. Basson's statement, which is official and has the approval of President Walsh, is printed elsewhere on this page.

The urgency of the situation, on both patriotic and practical grounds, has brought about a cooperative effort by the IA and the SMPE, for the first time in history. The engineers accepted President Walsh's ten points, laying down what the projectionist must do to conserve materials. They assigned a subcommittee of their Projection Practice Committee to work out the details of how the projectionist can best and most efficiently do what President Walsh says must be done. The report of this subcommittee was presented to the May 21st meeting, at which President Walsh was officially represented by Joseph Basson. Elsewhere in this issue of IP that report is printed in full. Practical projectionists joined with engineers in discussing the details of its application to varying projection room conditions.

Dr. Alfred N. Goldsmith, presiding, hailed the meeting as a cooperative enterprise of the SMPE and the IATSE, but stressed that it was called "for conservation, not conversation — we mean business." For the benefit of those members who were not aware of the background of the meeting, Goldsmith explained that the evening's program was to be based on the 10-point program originated by the President of the IA.

As the sub-committee's report was read, section by section, and in the general discussion that followed, a number of details were brought out elaborating on the recommendations submitted. Just how to prevent cement floor dust being swept into the equipment was one of these. Harry Rubin, projection supervisor for Paramount and for many years chairman of the Projection Practice Committee, recommended sweeping with a "no dust" compound: Dr. Goldsmith suggested painting the floor. Other suggestions offered included use of a vacuum cleaner, or of a damp mop; or covering some equipment, motor-generators specifically, with canvas covers made for that purpose and removed when sweeping is completed. The "strange but true" fact that over-lubrication is harmful to motor-generators of ball-bearing types was also brought out in the course of general discussion.

James Frank, of National Theatre Supply Company, predicted that theatres may have to obtain priority ratings in the future to buy certain forms of equipment, and warned of hardships unless existing materials are carefully conserved.

Tribute was paid by Dr. Goldsmith to P. A. McGuire, advertising and publicity manager of International Projector Corporation, for his assistance in arranging many of the details of this joint IA-SMPE meeting. "I find no words to express the gratitude the Society owes Mr. McGuire," he declared.

Dr. Goldsmith also read a letter from President Walsh, in which the IA chief said:

"Dear Dr. Goldsmith:

"As already explained to you and Mr. P. A. McGuire, the work of preparing for the Convention of the I.A.T.S.E. and M.P.M.O. which opens in Columbus, Ohio on June 1st, and the General Executive Board meeting there May 25th as well as the necessity of an early departure for the convention city to attend preliminary meetings as constitutionally required by our organization, makes it difficult for me and other officers to be present at the meeting of the Atlantic Coast Section of the Society of Motion Picture Engineers. I am, of course, thoroughly in sympathy with the objects of this meeting and have requested International Representative Joseph D. Basson to officially represent me at the meeting. He will express for me and for himself the well deserved praise of the report of the Projection Practice Sub-committee of the Theatre Engineers Committee, elaborating upon the Ten Point Conservation Program sent out over my signature in collaboration with the War Activities Committee of the Motion Picture Industry, under the Executive Vice-Chairmanship of Mr. Francis S. Harmon.

"I feel sure the entire membership of the I.A.T.S.E. and M.P.M.O. will also realize the patriotic purpose and practical value of this report, and their wide experience dating from the pioneer days in this field will enable them to meet emergencies as they always have in the past. The skill of our members will secure results which rise above even the highly important patriotic duty of conserving materials. To them is assigned the important responsibility of keeping motion picture entertainment at the highest possible level. Motion Pictures are essential to maintain the morale of the American people and it has already been conclusively shown that the well-being of their loved ones is also absolutely necessary to maintain the morale of the men in the field.

"The International Alliance of Theatrical Stage Employes and Moving Picture Machine Operators of the United States and Canada shall not fail in its patriotic duty and I am sure that the Meeting of the Atlantic Coast Section of the Society of Motion Picture Engineers at the Hotel Pennsylvania on May 21st will be an important contribution to the many activities the national government is urging in order that victory may come to the armed forces of our country at the earliest possible moment.

"With best wishes for a successful meeting, I am

"Sincerely yours,
"Richard F. Walsh.
"International President."

Statement Made by Mr. J. D. Basson at the S.M.P.E. Dinner

"Mr. Walsh asks me to tell you that it has been the position of the War Production Board that unless we can show material savings in war materials used by the industry, the Board intends to close some of the theatres. Unless consumption of such war materials is very materially reduced, that is what they will very likely do. Even if we were not willing to conserve materials for patriotic reasons, it is necessary to do so to protect the jobs of our members."

I.A. Pres. Walsh's 10 Points Worked Out in Detail by S.M.P.E. Committee

IN collaboration with the War Activities Committee of the Motion Picture Industry, Richard Walsh, president of the IATSE, recently announced a ten-point program designed to conserve vital materials needed for military purposes; to salvage such materials; and, by reducing waste to a minimum, enable the motion picture theatres to carry on during the present emergency.

In a message accompanying the printed program distributed to the theatres of the country, Mr. Walsh said, "Our country is at war. Here's how you can help. Every type of material is required in America's war effort. Many materials which you handle every day are scarce. Spare parts are hard to get. Your theatres may have to close unless the equipment that you handle is cared for and conserved. It is vitally important to maintain your projection, sound, and stage equipment in good operating condition. Only in this way can your theatre be kept open to do its vital job of maintaining morale. Conserve, Salvage, Eliminate Waste."

The 10 Points

The 10-Point Program is as follows:

(1) Keep your projection rooms and equipment clean. Dirt causes wear and tear.

(2) Lubricate properly all equipment. Follow the manufacturer's instructions.

(3) Make only necessary replacements to conserve spare parts.

(4) Burn carbons at minimum current specified by manufacturer. Use carbon savers where available.

(5) Clean lenses of optical systems with soft tissue and protect condensers and reflectors.

(6) Service regularly all electric current distribution points, such as: motors, generators, bus bars, fuses, switches, resistors, and condensers.

(7) Allow sufficient warming-up period for all vacuum tubes. Burn tubes at specified ratings of equipment manufacturers.

(8) Inspect, thread, and rewind film very carefully. Keep it clean.

(9) Handle reels and film containers with care; these can not be replaced.

(10) *Do Not Throw Anything Away.* Keep all worn out parts and metal coated carbon stubs; collect copper and other carbon drippings. Keep all burned out or broken vacuum tubes and incandescent lamps. You will receive instructions as to the proper disposal of this salvaged material.

The Projection Practice Sub-Committee of the SMPE Theatre Engineering Committee is wholeheartedly in agreement with the ten points and their aims and purposes. However, the Committee feels that the value of the ten points would be greatly enhanced if the projectionists of the country were informed more in detail of the ways and means of accomplishing the ten points. There is much beneath the surface in each of the points, and to bring out clearly all the details underlying the wordings of the points, the Projection Practice Sub-Committee has prepared the following elaboration of the ten-point program.

Herewith is presented the report of the Projection Practice Sub-committee, suggesting in detail how projectionists can most efficiently carry out President Walsh's 10 points for conservation of materials needed for military purposes.

(1) *Keep Projection Rooms and Equipment Clean. Dirt Causes Wear and Tear.*—Dirt has been the cause of serious film fires in preventing the proper operation of the automatic fire-shutter or in clogging the fire-valve rollers. It makes them susceptible to wear and renders them useless for the purpose intended.

Dirt may cause the stoppage of sound reproduction by accumulating on the various movable contacts or on the vacuum-tube contacts in the sound equipment.

It may cause losses in screen illumination, when deposited on the projection arc reflector or condensers, and has resulted in the rapid deterioration of carbon contacts with communicated damage to the adjacent parts of the lamp mechanism.

Dirt on the gear-teeth and shafts of the projector, combining with the lubricating oil, acts like a grinding compound, causing excessive wear and shortening the effective life of the gears and bearings.

On fuse-clips it causes high-resistance contacts and the generation of heat, which may sometimes cause the fuse to blow.

The Lamp House

Make sure that the lamp house and all parts are kept thoroughly clean both inside and outside. The carbon ash, drippings, *etc.*, should be removed regularly once a day, especially from the shafts, bushings, and gears of the arc control operating parts.

The arc exhaust dampers and ducts should frequently be cleaned thoroughly of carbon ash, dust, *etc.* Any blockage, no matter how small, will affect the proper burning of the carbons, cause pitting of the mirrors, and produce a gradual accumulation of ash within the lamp house. If there is a filter in the air-supply system, make sure it is in efficient working order. Care should be taken to prevent dust and dirt from blowing into the projection room through any windows if left open.

Motor-Generators

To get the most out of motor-generators, they should be kept clean, and all dirt should be removed before sparking becomes disastrous. Increased brush life as well as increased commutator life will be the direct result. Dirt on commutators causes arcing and pitting, shortening their life and increasing maintenance costs. The contacting surface of each commutator brush should be periodically examined so that commutator and bearing wear is held to a minimum. If the generator is on a concrete floor, care should be taken in sweeping, so that abrasive dust from the concrete will not get into the bearings. The exhibitor who is interested in keeping his projection maintenance costs low should extend to the projection room the same services used in cleaning the auditorium and other parts of the theatre. The projection room floor, walls, and ceiling should be of such materials that they will not "dust off." If the floor is of exposed cement, it should be kept well painted with "dust-proof" or "sealer" paint, and should be mopped frequently. A supply of lintless cloths for cleaning should be made available, as well as other cleaning facilities such as carbon tetrachloride, brooms and dust pan, metal waste can, and the like. In fact, these should be standard equipment of the projection room.

A stiff-bristled tooth-brush is useful for keeping the sprockets and idler rollers clean. The space between the fire-valve rollers and the castings in which they are mounted can easily be cleaned by inserting a narrow strip of film and drawing it back and forth to dislodge the dirt.

(2) *Lubricate Equipment Properly.*—Follow the manufacturer's instructions, and use only the grade of oil recommended by the manufacturer. The importance of lubrication of projection

equipment can not be overemphasized. Now that metals and oil have become important in our country's war program, we must regard the lubrication problem from the conservation viewpoint as well as the operating.

Projection equipment lubrication carried out properly and under manufacturer's instructions will lead to trouble-free operation.

The use of the proper types of oils and greases and their proper application will give longer life to the equipment and keep the standards of projection on a high plane.

The following rules should be strictly adhered to:

(1) Do not lubricate the mechanism while it is in motion. Doing so is hazardous both to the mechanism and to the projectionist.

(2) Do not over-lubricate. Excessive lubrication is costly and wasteful. It also impairs the quality of the sound and the picture. Only small oil cans that dispense small quantities of oil at a time should be used.

(3) Cleanliness in conjunction with lubrication is an important matter, since excess oil deposits promote the collection of dirt, dust, and grit on the vital parts of the projection equipment.

(a) Should the fire rollers become coated with oil, they will collect dust and grit, which will scratch the emulsion on the film. Such marring and destruction of film is very costly, and definitely does not contribute to our war effort.

(b) Deposits of oil, grease, and grit on the film strippers cause wearing of the sprockets and damage to the sprocket-holes of the film.

(c) Excessive oil on take-up devices causes them to slip, resulting in film mutilation by pile-up or sprocket breakage.

(d) All containers of oil should be kept carefully covered, and oil cans should be cleaned before being refilled.

(3) *Make Only Necessary Replacements.*—Due to the difficulty of obtaining replacement parts, it will be necessary to make the present parts last longer. The projectionist must assume greater responsibility in his care of the apparatus he operates. This means a daily inspection of the various items of the apparatus to insure to the utmost degree continuous, efficient operation. To a large extent this can be accomplished by systematic care to eliminate abnormal wear.

The projector mechanism has many precision-made parts. To reduce replacements and repairs to a minimum, the projectionist should keep his eyes constantly open for signs of uneven or jerky motion of the mechanism, and his ears attuned to any unusual noises during operation. A good practice is to turn the projector over by hand before the start of each day's show to see whether it revolves freely or not. If it seems to bind, the switch must not be thrown or serious damage may result. With the projector idle, try by hand the meshing of the teeth of the main drive gear, the lower sprocket pinion gear, and the intermediate gear. When the teeth on any or all of these gears show signs of rapid wear they should be realigned, otherwise new gears will shortly have to be installed.

At least once a week check the synchronizing marks on the vertical shaft gear, the intermediate gear, and on the intermittent movement flywheel to see whether they are in their proper operating relation. Watch the intermittent. Any slack that may develop between the star and the cam, or in cam and flywheel shafts, should be removed and every visible screw should be tightened at least once a month. This will avoid much future trouble.

Care should be taken when removing the intermittent sprocket, movement, or any other delicate part, not to strike the

Here are a few of those who attended the SMPE-IA meeting called to consider vital projection room conservation problems. Beginning at the top row and reading left to right, they are: Glenn Humphreys, Sec. I. A. Local 337, Utica, N. Y.; Morris Kravitz, Bus. Agt. I. A. Local 306, New York City; M. D. O'Brien, Asst. Director of Projection, Loews, Inc.; Wally Byrne, Past Pres. American Projection Society; James H. Maury, Mgr. Embassy Theatre, Easton, Penna.; Earl Morin, Connecticut Theatre Inspector; Donald E. Hyndman, Engineering Vice Pres. S. M. P. E.; E A. Williford, National Carbon Co, Inc; P. A. McGuire, Adv. Mgr. International Projector Corp.; Captain Styles, Connecticut State Police; Henry Anderson, Paramount Pictures; Ben Norton, Projectionist, March of Time; Dr. A. N. Goldsmith, Chairman Atlantic Coast Section, S. M. P. E.; Morgan Hobart, Photographic Service, W. P. B.; Joseph Basson, I. A. International Representative; Harry Rubin, Director of Projection, Paramount Theatres; N. D. Golden, U. S. Dept. of Commerce; and Sylvan Harris, editor of the S. M. P. E. Journal.

hard surface of the mechanism housing, as the good parts may be burred or jarred out of perfect alignment.

When the intermittent sprocket or star-wheel shows undue wear, tension on the pad or film guide should be checked and the spring compressed or released until the desired tension on both sides of the shoe is obtained. Too much tension wears the sprockets and may damage the film.

The pad rollers should be adjusted by the simple method of placing two thicknesses of standard 35-mm film on the sprocket held tightly over the teeth. The surfaces of the roller should be allowed barely to touch the film, and then the arm is tightened in this position. The rollers should be in line with the sprocket-teeth; that is, the teeth should operate in the recess formed in the rollers. A good practice is to wash the sprocket-teeth at least twice a week with a stiff-haired brush dipped in kerosene, and at least once a month the entire mechanism should be thoroughly cleaned with kerosene to remove all injurious foreign bodies.

Always, when making repairs, or installing gears, make sure beforehand that the proper procedure is thoroughly understood and that guide marks are scribed by hand on the parts or that the factory guide marks match in order to have perfect alignment. Proper tools should be available before starting any such work.

On some mechanisms the stripper plates and sprockets may be reversed when they show undue wear, but such reversing should be done very carefully and after some thought, as in some cases more harm can be done than good.

In the care and maintenance of the sound-head, practically the same precautions should be followed as indicated for the upkeep of the projector mechanism. The many electrical connections should be frequently checked and tightened. When a rotary stabilizer is used the roller should be left open at all times except when film is running in the projector.

Care of Magazines

The following list should prove helpful in the care and maintenance of the upper and lower magazines:

Tighten all screws.

Check the bushings, shafts, and reel locks.

Watch the upper magazine tension. Excessive tension causes fast wearing of the upper feed sprocket.

Keep the upper friction spring and collars clean and lubricated. Avoid jerky upper magazine feed.

When readjusting the take-ups, place a heavily loaded reel in the lower magazine. Start the motor, and, beginning with no tension, gradually tighten until the reel picks up and revolves slowly from any position in which it is stopped. Give an extra half-turn to the adjusting knob and lock it.

Do not wait for take-up belts to break. Change belts every thirty days, and allow oil-soaked leather belts to dry thoroughly. Carefully examine removed belts for breaks, bad spots, *etc.*

USE OF COPPER BANNED

Motion picture and projection equipment has been included in the War Production Board's latest list of items for which copper and its alloys may not be used. The ban extends to repair parts for such equipment. After May 31st, no listed article containing copper, brass or bronze may be manufactured, assembled or finished. However, the ban apparently does not extend to electrical wire or to copper-coated carbons, since the WPB order exempts use of copper solely for purposes of conducting electricity, and also exempts articles that are only plated, painted, sprayed or washed with copper. Bronze gears and bearings, however, apparently are included under the wording of the order.

Ventilating fans in rectifiers require periodic inspection and lubrication from one to two times a year. The rectifier should be located in a well ventilated, cool spot. A free flow of air should be maintained. Avoid placing rectifiers too close to other equipment or placing materials on top of them.

Bulb-type Rectifiers

In bulb-type rectifiers, the bulb sockets and clips should be inspected to make sure they are clean and not corroded or pitted. Sandpaper may be used to remove corrosion in order to make good contact. The bulbs should be secure in their sockets, and should be checked every few weeks. The various connections should also be checked.

The power input to the rectifier should correspond to the transformer rating. Voltages should be kept as close as possible to the recommended values. Variations over 10 per cent should be corrected.

A few precautions in the care and maintenance of rewinders, reels, splicers, and electrical change-overs will prove helpful in prolonging the useful life of the equipment.

Rewinder alignment should be checked. Aluminum reels should be handled with care, as new ones are not available.

Realign the splicer and check the cutting blades.

Once a month, check the change-overs and the foot-switches for proper contact and alignment.

(4) *Burn Carbons at Minimum Current Specified by Manufacturer. Use Carbon Savers Where Available.*—It is suggested that motion picture theatres operate projection lamps at or near the minimum arc current recommended for the trim in use if the resulting reduction in screen illumination below that at maximum recommended current can be safely tolerated. The general adoption of this suggestion should result in a considerable power and carbon saving, and for those theatres using copper-coated carbons, a substantial reduction in copper consumption.

It is felt that this suggested reduction in operating current, while bringing the level of screen illumination below recommended practice in many instances, will still permit acceptable projection of motion pictures and, for the duration of the war, is justified by the substantial saving of power and essential materials which can be accomplished in this manner.

Check ammeters and voltmeters in projector arc circuits to be certain they are accurate, before making any alterations in your present operations.

Check into the availability of reliable carbon savers on the market at the present time that will operate satisfactorily in your lamps. Be sure to use most economical carbon combination and length of carbons available for your lamps. Avoid striking an arc too soon.

(5) *Clean Lenses Properly and Protect Condensers and Reflectors.*—Lenses, condensers, and reflectors should be cleaned with special lens tissue or soft cloth. Avoid the use of abrasive cleaning materials or cloths containing fibers that scratch. Condensers and reflectors should be cleaned only when thoroughly cool, as any sudden cool draft may damage the optical system.

Most arc lamps are equipped with inside protective flame shields. These shields should be properly maintained.

Optical Systems

Projection optical systems should be cleaned every day before the show. Do not turn the mirror around in its holder, as in a very short time the entire surface will be pitted. Do not attempt to remove pits forcibly. Check the mirror-retaining clips for the proper holding tension; when too tight, the mirror may crack due to expansion.

Port glasses should be cleaned daily.

Treated lenses should be cleaned in accordance with the manufacturer's instructions. Keep oil from reaching the lens element. These instructions pertain to both sound and projection optical systems. Care should be taken to prevent chipping.

(6) *Service Regularly All Electric Distribution Points, Motors, Generators.*—Friction is the greatest cause of wear and tear on all rotating equipment.

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Review Of Projection Fundamentals

II.—Kinds of Particles

New technical problems will unavoidably be imposed on the projectionist by war conditions. At the same time, he will want to prepare himself for the technical surprises sure to appear when the war ends. In the conviction that our readers will consider the present an ideal time to review their knowledge of fundamentals, IP here presents the second of a series of articles dealing with the bases of electricity, optics, sound and other foundations of projection room technique.

THE projectionist occasionally encounters the names of particles—crystals, molecules, atoms, electrons and so on. They are mentioned from time to time in instructions manufacturers give with their equipment, and those instructions will be better understood if there is no confusion in the mind of the reader as to the relation of these particles to one another. Others the projectionist hears of now and then are ion, colloid, polymer, photon, proton.

Consider the first four—crystal, molecule, atom, electron. They can possibly be best remembered in terms of a city—a city is made up of streets, streets are made up of houses, houses are made of bricks; in the same way, by rough analogy, crystals are composed of molecules, molecules of atoms, atoms are built of electrons.

Electrons

Electrons, then, are the smallest of these particles. When they do *not* form part of an atom, when they are loose bricks so to speak, electrons constitute electricity. In motion they are an electron current. At rest they are an electric charge—negative charge. An abnormal scarcity of these loose or free electrons is a positive charge. Electrons will move if they can from a place of abnormal concentration (negative charge) to a place of abnormal scarcity (positive charge), and in so doing constitute an electric current flowing from negative to positive.

But electrons also group together to form atoms, as bricks may be grouped together with mortar to form a house. The details of the construction of an atom out of electrons and other things are still not too clearly understood, but for many purposes the so-called Bohr atom (worked out by a scientist of that name) offers a sufficiently accurate picture. Bohr suggested that a proton—a particle much heavier than the electron, and positively charged—constitutes the center of each atom; that electrons circle around this proton as the earth and the planets circle around the sun. Ninety-three combinations of this kind are known, constituting ninety-three different kinds of atoms.

Neither electrons nor atoms can be seen by any microscope; however, they are not imaginary particles. They are real, but what is known about them had to be worked out in indirect ways, not by looking at them.

Atoms and Molecules

Atoms group together to form molecules. For instance, the ordinary oxygen we breathe does not exist in the air as atoms of oxygen, but as molecules, each molecule composed of two atoms, O_2. An electric spark causes these atoms temporarily to regroup into a different molecule containing three atoms, O_3 or ozone. The molecules in an atom are not always the same kind. They may be different kinds, as in water, two hydrogen atoms and one of oxygen. In a common lead storage battery, the process of giving off current causes hydrogen from the sulphuric acid to unite with oxygen from the lead dioxide of the positive plate, forming water. When the battery is charged, the charging current reverses this process, disintegrating the water by splitting its oxygen from its hydrogen. The oxygen goes back to the positive plate, and the hydrogen atoms again become parts of molecules of sulphuric acid.

The molecule is therefore larger than the atom, and composed of atoms. Some molecules are very complex combinations of hundreds or thousands of atoms, and large enough to be made visible by microscopic techniques. Although electrons can combine in only 93 different ways to form atoms, atoms can combine in millions of ways to form millions of different kinds of molecules.

Crystals

Crystals are still larger than molecules, since they consist of groupings of molecules—many of them can easily be seen with the naked eye. Their importance to the projectionist is not confined to crystal phonograph pickups or crystal headphones. Most metals are crystalline in structure. The crystals of iron are easily seen with a low-power microscope if surface corrosion is first cleaned away by a touch of strong acid. Metals change their crystalline structure sometimes, their crystals grow by regroupings of the molecules that form them. This takes place more rapidly and easily at elevated temperatures. The metal often is weakened physically by this increase in the size of its component crystals. Hence copper wire is said to become "crystallized" when overheated by passing excessive current through it; its crystals increase in size by molecular re-grouping, weakening the wire.

Crystals of Rochelle Salts used for microphones, phonograph pickups and headphones are grown to large size, entirely visible to the naked eye, large enough to be picked up and handled.

Crystals disappear when the material they form is melted; sometimes they re-form when the material is cooled. allowing it to solidify. There are no liquid or gas crystals; molecules group together in crystalline formations only in the solid phase.

Ions

A special, temporary particle of considerable practical importance to the projectionist is the ion. This is either an atom that has temporarily gained or lost electrons, or it is a part of a molecule which has been disrupted in such a way that its parts are electrically charged. All ions exist only temporarily, because their electrical charges compel them to unite with other ions. forming molecules; or if the ion is an atom it gains or loses electrons until it returns to its normal atomic state. In a mercury vapor rectifying tube the gas, bombarded by electrons from the filament, changes from atoms of mercury vapor to ions of mercury—that is, atoms which have lost one or more electrons by bombardment. These ions, being positive by virtue of having lost some of their normal quota of electrons, migrate toward the negative filament, and sooner or later restore themselves by attracting some slow-moving electrons of the emission stream. Meanwhile the electrons they lost, being negative, are attracted to the positive plate, and migrate there, constituting a flow of current across the tube. In the storage battery, the sulphuric acid—H_2SO_4—is ionized by the action of the water in which it is dissolved, and breaks up into three ions. two of hydrogen, which are positive, and one sulphate ion—SO_4—which is negative. Note that the sulphate ion is itself composed of five atoms, whereas

(Continued on following page)

PROJECTION FUNDAMENTALS

(*Continued from preceeding page*)

each hydrogen ion is only a part of one atom.

To sum up to this point: electrons group together with a proton to form atoms, atoms clump together to form molecules, molecules line up in various patterns to form crystals.

The projectionist also encounters on occasion such words as colloid—projection carbons are sometimes said to consist of "colloidal carbon"—polymer, and photon.

Colloid Particles, Etc.

Molecules sometimes clump together to form groups which are not crystalline, do not look or act like crystals. A very small particle, usually submicroscopic, consisting of several molecules, is sometimes called a colloid particle. The black soot of which projection carbons are made is not crystalline, yet each small soot particle is far larger than a single molecule. Colloid particles, having no crystalline shape or pattern, can be liquid as well as solid.

Plastics—bakelite, rubber and motion picture film—are polymers. In these molecules are grouped together, but not in a rigid pattern as in crystals. The pattern may be flexible, even elastic, yet the molecules cling to each other with enough force to give the substance considerable physical strength. There are no particles; one molecule clings to the next throughout the entire extent of the substance. It is noteworhy that when molecules are grouped together in crystalline form the substance is often (though not always) a good electrical conductor; when molecules group together to form a polymer the substance is usually a very good insulator.

A photon is a unit of light energy, and possibly also a "particle" of light. Light of course usually acts as if it consisted of waves, so much so that the wave-length of different colors of light can be accurately measured; yet in some actions the behavior of light can best be interpreted on the assumption that it consists of particles. There is a similar ambiguity in the case of electrons; they usually act as if they were particles, and those particles have been weighed and measured; but some types of electrical action are best interpreted on the assumption that electrons are a wave motion. This riddle has not yet been cleared up. Meanwhile light certainly has energy; it does actual work in a photocell in producing emission of electrons from the photo-sensitive surface. The photon is a unit in which light energy is measured, it may or may not prove to be a particle of light also.

Underwriters Code As It Affects Projection Rooms

Every projectionist knows that his equipment and operations, and any changes he may make in his equipment, must meet the Fire Underwriters' requirements. How many projectionists know what those requirements are in detail? IP will reprint from time to time portions of the National Electrical Code that are important to the projection room, and amendments to the Code as they are issued. Herewith is presented the second installment, with some of the definitions and wiring rules that will be needed for understanding subsequent installments. IP welcomes inquiry on practical application of the Code to projection room problems.

II.

Wet Location: A location subject to saturation with water or other liquids, such as locations exposed to the weather, wash rooms in garages, and like locations. Installations underground or in concrete slabs or masonry in direct contact with the earth, shall be considered as wet locations.

Master Service: The service conductors and service equipment supplying a group of buildings under one management.

Motion Picture Studio: Any building or portion of a building in which motion-picture films are manufactured, developed, printed, rewound, repaired, stored or otherwise exposed.

Multi-Outlet Assembly: A type of surface metal raceway, designed to hold conductors and plug receptacles, assembled in the field or at the factory.

Outlet: A point on the wiring system, at which current is taken to supply fixtures, lamps, heaters, motors and current-consuming equipment generally.

Outline Lighting: An arrangement of incandescent lamps or gaseous tubes to outline and call attention to certain features such as the shape of a building or the decoration of a window.

Panelboard: A single panel, or a group of panel units designed for assembly in the form of a single panel; including buses and with or without switches and/or automatic overcurrent protective devices for the control of light, heat, or power circuits of small individual as well as aggregate capacity; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front. (See switchboard.)

Portable Appliance: An appliance capable of being readily moved where established practice or the conditions of use make it necessary or convenient for it to be detached from its source of current by means of flexible cord and attachment plug.

Qualified Person: One familar with the construction and operation of the apparatus and the hazards involved.

Raceway: Any channel for holding wires, cables or bus-bars, which is designed expressly for, and used solely for, this purpose:

Raceways may be of metal, or insulating material, and the term includes rigid metal conduit, flexible metal conduit, electrical metallic tubing, underfloor raceways, cellular metal floor raceways, surface metal raceways, wireways, busways and auxiliary gutters.

Raintight: So constructed or protected that exposure to a beating rain will not result in the entrance of water.

Rating: (Of fuse). The current rating of a fuse is a designated value of current in amperes marked on the fuse.

Rating: (Of circuit-breaker). The current rating of a circuit-breaker is the current value in amperes marked on the breaker.

Readily Accessible: Capable of being reached quickly for operation, renewal, or inspection, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc.

Receptacle Outlet: An outlet equipped with one or more receptacles, not of the screw-shell type, or provided with one or more points of attachment within one foot or less, intended to receive attachment plug caps.

Sealable Equipment: Equipment enclosed in a case or cabinet that is provided with means for sealing or locking so that live parts cannot be made accessible without opening the enclosure. The equipment may or may not be operable without opening the enclosure.

Secondary Neutral Grid: A well grounded network of neutral conductors formed by connecting together within a given area all the neutral conductors of individual transformer secondaries of the supply system.

Service: A service is the conductors and equipment for delivering electric energy from the secondary distribution

(Continued on page 21)

10 POINTS ELABORATED

(*Continued from page* 14)

Anything that can be done to reduce friction will tend to increase the life of all such equipment. It is, therefore, impossible to place too much emphasis on cleanliness of the equipment as well as of the surroundings of such equipment.

In order to prevent dust and dirt from dropping or being blown into the unit itself, all walls as well as the floor and ceiling of the motor-generator room should be painted and cleaned regularly.

Lubrication of the unit should be done in accordance with the instructions of the manufacturer and a chart should be kept of such lubrication to show the regularity of such service. Bearings should be drained at regular intervals of not more than six months and refilled with a good grade of oil, of a viscosity as recommended by the manufacturer.

Brush contact should always be good and the tension should be kept at the minimum that will not allow sparking. Brushes should be staggered so as to allow even wear across the entire width of the commutator. Never use brushes other than the grade recommended by the manufacturer.

Keep all slots in undercut commutators clean by the use of a wooden stick of the proper width, and never use oil on any commutator. If necessary to use an abrasive on the commutator, clean both brushes and commutator thoroughly afterward. Keep the shaft and couplings in proper alignment. Blow out all dust and dirt from the windings of the unit with a blower.

Alignment of the motor and generator shafts should be checked and the couplings kept tight. Misalignment and looseness cause vibration, increased wear, and replacements.

(7) *Allow Sufficient Warming-Up for Vacuum Tubes. Burn Tubes at Specified Ratings.*—It is important that amplifier and rectifier tubes be pre-heated and become stabilized at operating temperatures before the sound system is operated. Usually a fifteen-minute period is sufficient for this purpose. Certain types of tubes, particularly rectifiers, require a pre-heating period to allow the electron emission to become stabilized so that all parts of the filament are liberating electrons before the plate voltage is applied to the tube. If the plate volage is applied before sufficient electrons have been emitted, the surface of the filament may be damaged, or part of the filament may be burned away at one spot.

Many of the larger tubes have spiral extension springs to take up the slack of the filament resulting from expansion and elongation due to the heating. Sufficient pre-heating time should be allowed to permit the filament to assume its normal operating position before applying the plate voltage.

Mercury Vapor Tubes

Mercury-vapor tubes must be preheated to drive the mercury from the filament and plate elements of the tube before applying the anode voltage. This usually requires three to five minutes, depending upon the location of the mercury in the tube and whether or not the tube had previously been pre-heated. Tubes of this type should have an initial pre-heating period of five to fifteen minutes and then used for two or three days. They can then be stored in a vertical position for future use.

Once a mercury-vapor tube has had an initial pre-heating, and all the mercury has been driven off the tube elements, the daily pre-heating period is much shorter than when the tube is first put into operation.

Equipment manufacturers issue instructions regarding pre-heating of tubes where necessary. Follow these instructions carefully.

Tubes should be operated at the vol-

tage ratings specified by the manufacturer. An accurate meter should be used in making these measurements. A majority of installations are provided with a 110- to 120-volt switch to adjust the primary input voltage. If the amplifier or unit is not equipped with a switch of this type, the voltage may be adjusted by moving the tap on the primary of the power transformer. Operating the tubes on line voltages above the normal value will not add anything to the output of the tubes but will only decrease their life. Operating the tubes below their normal rated voltages also shortens tube life.

(8) *Inspect, Thread, and Rewind Film Carefully. Keep It Clean.*—Film should at all times be carefully handled. It should be kept away from all sources of heat, except the normal heat during projection. The regulations against smoking should be obeyed.

Film should under no circumstances be left lying exposed on benches or elsewhere, but should be immediately placed in metal containers or cabinet after use.

Care of Film

Film should be inspected each time before it goes through the machine. The only way that film can be properly inspected is by slowly winding the film by hand. Inspection should cover tears, splices, and defects in sprocket-holes. Do not use bent reels. Use fresh film cement for making all splices.

Film should be carefully threaded through the machine. It should be in proper place on every roller, gate, and sprocket. Excess slack at top and bottom of machines should be taken up before the machine is started. Magazine doors should be closed as soon as the film is threaded and should be kept closed during the entire operation.

(9) *Handle Reels and Film Containers with Care; They Can Not Be Replaced.*—A bracket or rack should be erected on which to keep all empty reels instead of allowing them to lie on the floor or elsewhere where they may be damaged.

Film-storage cabinets and shipping cases should be kept clean. Bent reels should be saved, as manufacturers are making arrangements to straighten them.

After putting reels into the film cabinet, the compartment door should be closed by hand. It should not be allowed to snap back into place by its own weight. Care should be taken that ends of film do not stick out.

(10) *Do Not Throw Anything Away.*—Because of acute shortages of many materials, and the difficulty of obtaining replacements for theatre equipment, all broken and worn out parts should be saved.

Save all gears made from steel, bronze, brass, or other material. Sprockets, pad-rollers, blades and jaws of old switches, copper wire, arc-lamp jaws, and other metal parts should be accumulated for disposition at some future date.

Do not throw away a transformer or motor of any kind. The copper can be reclaimed and the cores can be used again. There are some manufacturing concerns who will not ship a new transformer unless the old one is returned.

Broken aluminum reels and other aluminum parts should be welded or otherwise repaired. This is a critical metal, and if the part can not be mended, save the aluminum.

Reel and trailer cans should be returned to the film exchanges. Nearly every projection room has an accumulation of these cans which is taking up valuable space.

The country needs copper. Remove and save the copper coating from old copper-covered carbon stubs. Save all the copper drippings from copper-coated projector carbons. Provide a metal pail in which to store the copper.

Keep the accumulation of metal parts by placing metals of one kind in one box or pail and metals of another kind in another box. This will assist in keeping the different metals separated and facilitate disposing of them.

U. S. War Workers Beat Britain's No-Strike Record, Says Green

In a signed editorial in the American Federationist, AFL's official organ. President William Green writes as follows:

"Sir Gerald Campbell says of strikes in Great Britain: 'After Dunkirk it was agreed that production should not be interrupted by stoppages of work. Since May, 1940, strikes have virtually ceased. The time lost since then is one day per man in fifteen years—a situation which could only have been achieved by common consent of employer and employe, the sort of thing which cannot be achieved by a mere legislative act.'

"There you have the strike rate in Britain—one day lost per man in fifteen years of work. That is a splendid record. But here in America we have greatly improved upon the record of British labor. Since Pearl Harbor our strike rate in war work has been one day per man in thirty years of work."

LOCAL 306 SURVEYS WAR SKILLS

In cooperation with the War Production Training Committee of the American Theatre Wing War Service, Inc., Local 306, New York City, is surveying skills and potential skills of its members which may fit them for war production work. Every member will receive a questionnaire, distributed by Nat Doragoff, Recording Secretary, who has been appointed by the Executive Board to carry out the survey.

In a circular letter, Doragoff explains the questionnaire as follows:

"The object of the committee is to make a complete survey of the existing latent and potential skills and occupational aptitudes of each and every member of the whole theatrical profession and their fitness or preference for any kind of war production work."

UNDERWRITERS CODE

(*Continued from page 17*)

or street main, or from a distribution feeder, or from the transformer, to the wiring system of the premises served.

Service Cable: Service conductors made up in the form of cable.

Service Conductors: That portion of the supply conductors which extends from the street main or duct or from transformers to the service equipment of the premises supplied. For overhead conductors this includes the conductors from the last line pole to the service equipment.

Service Drop: That portion of overhead service conductors between the pole and the first point of attachment to the building.

Service - Entrance Conductors: That portion of service conductors between the terminals of service equipment and a point outside the building, clear of building walls, where joined by a tap or splice to the service drop or to street mains or other source of supply.

Where service equipment is located outside the building walls, there may be no service-entrance conductors, or they may be entirely outside the building.

Service Equipment: The necessary equipment, usually consisting of circuit-breaker or switch and fuses, and their accessories, located near point of entrance of supply conductors to a building and intended to constitute the main control and means of cutoff for the supply to that building.

Service Raceway: The rigid steel conduit, electrical metallic tubing, or other raceway, that encloses service-entrance conductors.

Setting: (Of circuit-breaker). The setting of an instantaneous trip circuit-breaker is the current value, in amperes, at which it will trip; the setting of a time-delay circuit-breaker is the value of current, in amperes, which it will carry indefinitely and beyond which it will trip at specified values of overload and time.

Show-Window: A show-window is any window used or designed to be used for displaying of goods or advertising material, whether it is fully or partly enclosed or entirely open at the rear, and whether or not it has a platform raised higher than the street floor level.

Special Permission: The written consent of the authorities enforcing this code.

Switches:

General-Use Switch: A switch intended for use as a switch in general distribution and branch circuits. It is rated in amperes and is capable of interrupting its rated current at its rated voltage.

(*To be Continued*)

NTS Announces Budget Plan for Projection Repairs

National Theatre Supply Company has brought out a budget plan for repair of projection equipment. Payments may be made weekly or monthly, and may be spread over a period of one year.

Effective at all 22 NTS branches, the budget plan covers repair of projector mechanisms, repair of lamphouses, repair of magazines, regrinding and surface-treating of projection lenses, replacement of motion picture screens, and purchase of projection room accessories including lubricants, fire protective supplies and spare vacuum tubes.

The budget arrangements are operated and financed entirely by NTS.

Dr. Bausch, of B. & L. Gives Museum to City of Rochester

Scholars and savants from far and wide thronged the new Bausch Hall of Science and History to share in the dedication of a new $521,000 museum building given by Dr. Edward Bausch, of Bausch and Lomb Optical Co., to the people of Rochester.

Prevented by illness from participating in the ceremonies, Dr. Bausch was represented by Herbert Eisenhart, president of the Bausch & Lomb Optical Company, who presented the building to Mayor Samuel B. Dicker, the city's representative, in the presence of a notable gathering of celebrities, among whom were Dr. Vilhjalmur Stefansson, who delivered the dedicatory address, and Dr. Alfred Noyes, English poet laureate, who addressed the convocation on the day preceding.

Coated Lenses Will Be Used on World's Greatest Telescope

The world's largest telescope, the 200-inch eye soon to be put into operation on Mount Palomar, California, will be far more powerful than its designers dreamed because of application of the same principle of coated lenses used in the modern projection room.

Lenses and prisms associated with the giant mirror will be coated with metallic films one one-millionth of an inch in thickness, and this improvement, plus recently-developed and superior photographic plates, will raise the efficiency of the telescope to nearly double the original expectation of its creators.

American Weekly, which reveals this development, points out that the telescope cost $6,000,000 to construct, but the changes that will almost double its efficiency will cost only $30.

The problems of the astronomer and the projectionist are alike in the one point that neither can afford to waste light. The scientists who will man the new giant eye will need every scrap of starlight it can gather, because they will try to photograph stars so far away that the light left them 500 million years ago and has been on its way to the earth ever since. Projectionists also need to conserve light—coated lenses serve both crafts.

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Malco Theatres, Inc.
Memphis, Tenn.

Personally, I think that any exhibitor who is fortunate enough to have a copy of the 1942 Year Book in his possession should treasure it. I pride in it as much as the average person does a dictionary and refer to it many, many times, and find it very useful for reference purposes to anything pertaining to the industry.

Thomas W. Goldberg
Walbrook, Harford and Hilton Theatres.
Baltimore, Md.

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PROJECTIONIST

JUNE 1942

VOLUME 17 • NUMBER 6

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A N N O U N C I N G

The New Victory Carbons

Designed to Conserve Copper for War Needs

Winning this war is the first objective of every American. The will for Victory includes taking in stride whatever sacrifice or inconvenience may be occasioned by the demands of our war effort.

Government curtailment of copper necessitates reducing the thickness of copper coating on "National" copper coated high intensity projector carbons. This may result in a slightly longer spindle on the carbons, and in the case of the 7 mm — 6 mm combination, may result in some reduction in screen illumination, although there will still be sufficient light for satisfactory projection.

Fortunately, the culmination of research work on the 8 mm — 7 mm trim makes it possible to burn these new carbons, even with the thinner copper plating, and to obtain even more light with the same current formerly used (within limits of the new maximum). Savings as high as 30% in carbon consumption can be had for the same amount of light on the screen if the present light level is satisfactory. When using power sources designed for "Suprex" type lamps similar savings can be made, while retaining the same screen illumination as formerly, by shifting from 7 mm — 6 mm trims to the new 8 mm — 7 mm. To accomplish this may require enlarging present carbon holders, which can be done with little effort.

Operation at reduced arc current may also, in some instances, necessitate readjustment of the feed ratio of the projection lamps in order to maintain correct position of the carbons with a minimum of manual adjustment.

The trade-mark on these new Victory carbons is imprinted in *white*, instead of the familiar *blue*. Maximum allowable arc current is also stamped on each carbon. It is important that this current limitation be observed.

The words "National," "Suprex" and "Orotip" are trade-marks of National Carbon Company, Inc.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Save the Copper

Most of the copper used for plating copper coated projector carbons drops to the floor of the lamp house when the carbons are burned. Continue to save these copper drippings and turn them over to an authorized scrap dealer or to such other agency as may be designated by our government.

RECOMMENDED TRIM AND RANGE OF ARC CURRENT FOR LAMPS USING COPPER COATED, HIGH INTENSITY, PROJECTOR CARBONS

Type of Arc	*Arc Current — Amperes*	*New Victory Carbons — Size and Type*
"1 Kw" High Intensity, A.C.	52-66	7 mm x 9 inch H.I., A.C. Carbons in both holders
"1 Kw" High Intensity, D.C.	40-42	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *adjustable* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *fixed* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C.	56-65	8 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative

★ ★ ★ ★ ★ ★ ★ ★ ★

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by Aaron Nadell

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Monthly Chat

HARRY SHERMAN, formerly Assistant President of the IA, President of Local 306, New York, and labor negotiator for Paramount Theatres, Inc., joins the staff of IP with this issue. He will report IA news and events. Brother Sherman's membership in the International dates back to 1915; his friendship and acquaintance with fellow-members of the craft covers every corner and nook of the United States, and most of Canada. Fortunate is the publication whose star reporter is on nickname terms of friendship with those whose activities he reports.

• • •

Now overtime will be waived by IA members when Army-Navy Emergency Relief Drive collections are taken up in theatres. President Richard Walsh has pledged this to Nicholas M. Schenck, national chairman of the Theatre Division of the Army-Navy Drive. Time actually consumed in making auditorium collections will, in short, be donated by the craft.

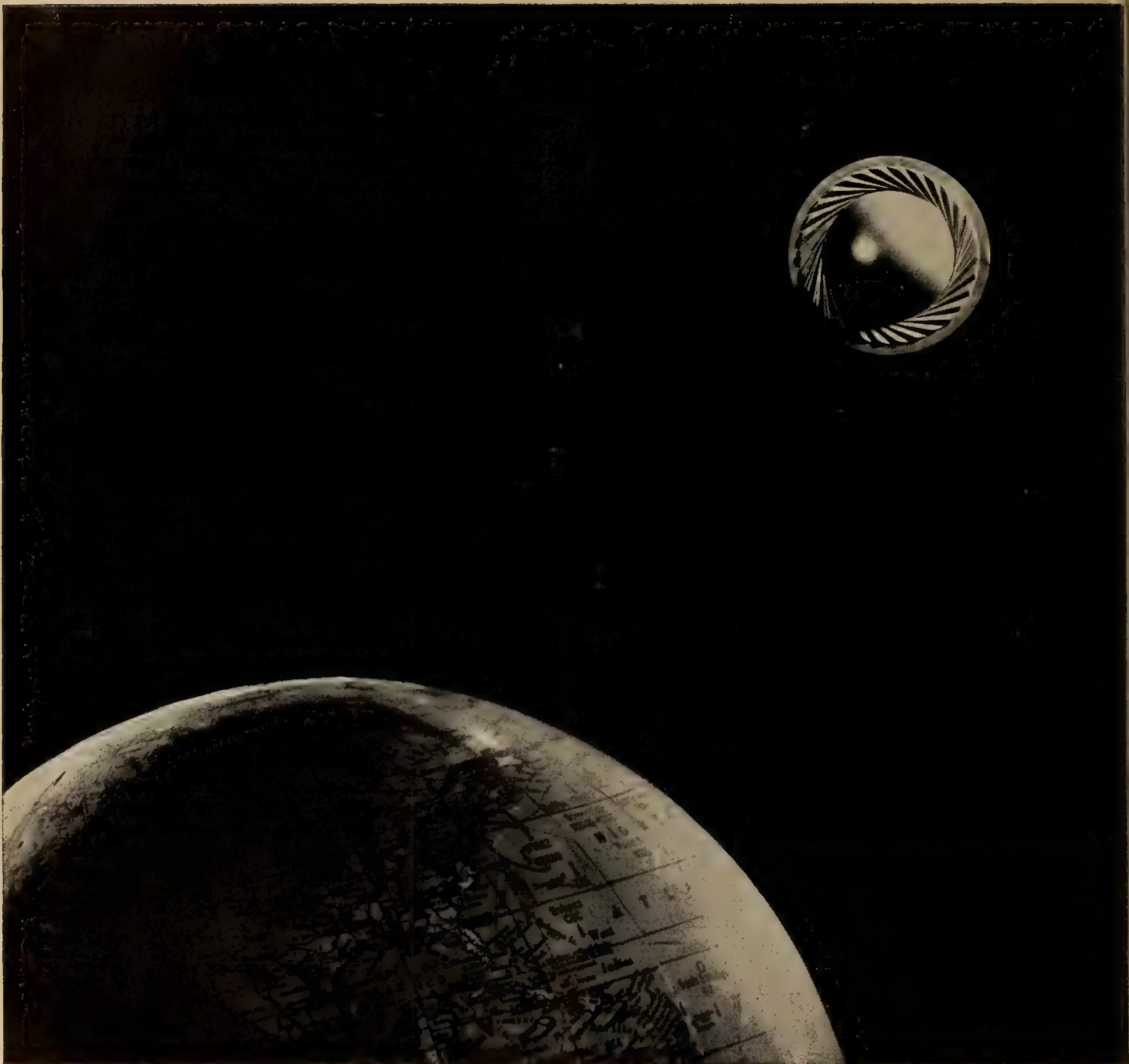
• • •

Purchase of replacement and repair parts made by the manufacturer of the equipment would seem to be more strongly indicated than ever under current conditions. Projection rooms in any case are likely enough to present pictures of heroic patchwork before this emergency is over. While they can be obtained, and to the fullest extent that they can be obtained, manufacturers' "original" parts will help keep the inevitable substitutions of wartime to a minimum.

• • •

How the armed services use motion pictures for instruction and entertainment of personnel, as well as for study of mechanical and ballistic problems, forms a fascinating story, some small portions of which have already been presented in these pages. IP plans a more extensive presentation of this matter which will cover, as far as Army and Navy authorities permit, both the use of projection equipment by the services and the duties, ratings and training of the men who operate projection apparatus for Uncle Sam. Related, of course, is the extensive use of sound equipment, with or without microphones, for all sorts of communications and miscellaneous services, including issuance of orders. For instance, nobody can ever hope to "murder the bugler" in this man's army. He's a phonograph record.

A. N.



INTERNATIONAL PROJECTIONIST

VOLUME XVII JUNE 1942 NUMBER 6

The New Victory Projector Carbons†

By E. R. GEIB

MANAGER, ARC DEPARTMENT, NATIONAL CARBON COMPANY

THE recent important announcement by National Carbon Company, Inc. of the new Victory high intensity projector carbons designed to save copper for war needs is of particular interest to all projectionists and should receive their closest attention. It is a part of the national program to conserve vital metals and as such it deserves the maximum cooperation of all concerned. In its announcement National Carbon Company, Inc., states that government requirements of copper for war purposes makes it impossible to continue the production of "National" "Suprex" and "Orotip" C copper coated high intensity projector carbons with the thickness of copper coating formerly supplied. This situation has been met by the introduction of these new "National" Victory carbons with reduced thickness of copper coating.

Identifying the Carbons

To facilitate the identification of the new Victory carbons a special attractive red label has been affixed to the packages, and as a further means of identification the trade-mark on each carbon is imprinted in white instead of the familiar blue imprint formerly used. To assist the projectionist in the proper use of the Victory carbons the maximum allowable arc current is also stamped on each carbon. *It is important that this current limitation be observed.*

In general the reduction in the thickness of copper coating of these Victory carbons lowers the upper limit of arc current at which these new carbons can be operated with satisfactory results. Because of this theatres which have been operating their lamps at the maximum allowable current for the carbons of normal copper coat thickness previously available may experience some reduction in screen illumination. However, there should still be sufficient screen illumination for acceptable projection. The change in copper coating may also result in slightly less steady light and in a little longer spindle. On the other hand these carbons will give as much light and essentially as long carbon life as that obtained at corresponding arc current from the carbons formerly supplied. In fact, some theatres will actually obtain more light than formerly while in many other instances practically no difference in screen illumination will be observed.

The reduction in arc current may, in some instances, require the adjustment of the feed ratio of the projection lamps in order to maintain correct position of the carbons with a minimum of manual adjustment. On some lamps it will be necessary to use a larger diameter negative carbon to adapt the burning ratio of the carbons at reduced arc current to the fixed feed ratio of the lamp.

Some projection lamps are adjusted to obtain maximum efficiency in screen light production by focusing the crater image close to the dimensions of the film aperture when the lamp is operated at maximum allowable arc current. With such adjustment, reduction of arc current to the limit of the thin coated carbon may result in dark or discolored corners on the screen. If this condition is encountered, the lamp manufacturer should be consulted for instructions covering the mirror adjustment needed to correct this condition.

Details of Operation

Specific details in the operation of the Victory carbons in the various types of projection lamps follows.

D. C. High Intensity Lamps Using 8 mm Positives will now use the 8 mm x 12 or 14 inch "Suprex" positive with the 7 mm x 9 inch "Orotip" C negative for the entire operating range of 56-65 amperes. The 6.5 mm negative carbons have been withdrawn from the market and will not be available for the duration.

The original trim for these lamps, prior to the Victory carbons, consisted of an 8 mm "Suprex" positive carbon

† Read bfeore IA Columbus Convention.

paired with either 6.5 mm or 7 mm "Orotip" C negative designed for a current range of from 56 to 65 amperes. A little over a year ago, as a result of months of intensive research work, an improved 8 mm "Suprex" positive carbon having a current carrying capacity of from 56 to 70 amperes was placed on the market. This new carbon was at first introduced in a restricted territory and its distribution had been gradually increased to a point where almost one-half of the country was receiving it and its distribution was about to be extended to the Atlantic seaboard and Pacific coast when the copper conservation program was put into effect. The principal improvement in this new carbon is a shell of higher current carrying capacity than that used on the original 8 mm "Suprex" positive. The thinner copper coating has been applied to this new carbon and it has been adopted in place of the regular carbon. The current range for the new Victory type 8 mm "Suprex" positive is from 56 to 65 amperes the same as of the regular 8 mm positive.

As previously stated the 6.5 mm "Orotip" C negative has been withdrawn from the market and the 7 mm x 9″ "Orotip" C negative carbon is recommended in its place. Those who are now using the 6.5 mm negative carbon will find it necessary to ream out the present holders or to obtain new holders.

Improvement in Light

Theatres still using the old 8 mm "Suprex" positives will realize a marked improvement in both screen light and carbon life from the introduction of the Victory carbons. At corresponding values of arc current, approximately 20 per cent more screen light will be obtained with a slight saving in carbon life. The maximum screen light from the old carbon will be supplied by these Victory carbons at 5 amperes less arc current with a saving of about 25 per cent in carbon consumption.

From 56 to 60 amperes these new carbons, like the type they supersede, give steady light when operated from a low voltage power source designed for "Suprex" type lamps. If the power supply is of the type designed for Hi-Lo lamps, with 70-85 terminal voltage, these new carbons may show some unsteadiness at arc currents below 60 amperes. This can be overcome by using a by-pass resistance on the generator series field to reduce the terminal voltage to 60. Information regarding a suitable resistance can be obtained from the generator manufacturer.

If the arc is operated directly from a D.C. power supply with voltage reduced to arc value entirely by ballast resistance, it is necessary that an arc current of not less than 60 amperes be maintained to avoid unsteady operation.

High Intensity

D.C. High Intensity Lamps with Adjustable Feed Ratio Using 7 mm Positive Carbons will use the 6 mm x 9 inch "Orotip" C negative with the 7 mm x 12 or 14 inch "Suprex" positive in these lamps. The operating range is 42-45 amperes. Since the maximum arc current for the Victory carbons in this size is 45 amperes, theatres which have been using higher arc current will encounter some reduction in screen light. The light and carbon life, however, will be equal to that obtained from carbons formerly supplied at corresponding values of arc current. Since the ratio of burning rate between positive and negative carbons changes with change of arc current, adjustment of the feed ratio will have to be made when lamps previously operated above 45 amperes arc current are reduced to that value.

D. C. High Intensity Lamps with Fixed Feed Ratio Using 7 mm Positive Carbons: The feed ratio on lamps of this type is designed for operation at 50 amperes arc current. Reduction of the arc current to the 45 ampere limit of the Victory type 7 mm "Suprex" positive carbon necessitates the use of a 7 mm "Orotip" C negative to obtain a burning ratio corresponding to that of the feeding mechanism. Since the negative carbon holder is designed for a 6 mm carbon, it must be reamed out or replaced with a new holder of suitable diameter to accommodate the 7 mm thin coated carbon. Light obtained at corresponding values of arc current, within the operating range of 42-45 amperes, will be the same as from carbons formerly supplied and the same is true of positive carbon life. Negative carbon life will be greater due to increased diameter of the negative carbon.

"One Kilowatt" D. C. High Intensity Arcs: These lamps use the 7 mm x 12 or 14 inch "Suprex" positive with a 6 mm x 9 inch "Orotip" C negative. Since the operating range of these lamps, 40-42 amperes arc current, is below the maximum capacity of the trim used, no reduction of screen light or carbon life will follow the introduction of the Victory carbons.

"One Kilowatt" A. C. High Intensity Arcs: The Victory type carbon for 96 cycles, A. C. high intensity lamps is a new 7 mm x 9 inch high intensity A. C. carbon, to be used in both holders. The current range is 52-66 amperes.

New Chore for Small Theatre Projectionists

Connecticut State Police have asked all motion picture theatres in the New Haven district to install emergency lighting systems as a precaution against air raids or other damage. For the present, compliance will be voluntary. It is expected that in smaller houses projectionists may take charge of watering and charging batteries, and other details of maintenance.

USE OF METALS CURBED

As another step toward strict allocation of scarce materials and improved control of priorities, J. S. Knowlson, Director of Industry Operations, ruled that all but a few classes of companies requiring more than five thousand dollars worth of metal for the third calendar quarter of 1942 must apply for priority under the Production Requirements Plan.

Summary of Trims and Range of Arc Current for Lamps Using Copper-Coated, High Intensity, Projector Carbons

Type of Lamp	Arc Current—Amperes	New Victory Carbons—Size and Type
"1 Kw" High Intensity. A. C.	52-66	7 mm x 9 inch H.I., A.C. Carbons in both holders
"1 Kw" High Intensity, D. C.	40-42	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D. C. with adjustable feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" N Negative
Simplified High Intensity, D. C. with fixed feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D. C.	56-65	8 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative

The words "National," "Suprex" and "Orotip" are trade-marks of the National Carbon Company, Inc.

I.A. Thirty-sixth Convention Report

RE-ELECTION of all incumbent officers, and adoption of a number of changes in the Constitution and By-laws, featured the Thirty-Sixth Convention of the International Alliance of Theatrical Stage Employes held this month at Columbus, Ohio.

Delegates told each other it was one of the most highly successful conventions in IA history, marked by a strong sense of unity and friendship despite a highly spirited election. Evidence of that unity was concretely shown by the motion of an unsuccessful candidate, William T. Bennett, to make the election of his opponents unanimous, and by the immediate and hearty acceptance of that motion.

National patriotism was a powerful undercurrent throughout all five days' business. A dozen or more patriotic resolutions were offered and adopted; a devoted interest in the national welfare at times almost obscured the interests of the IA which the convention was called to serve.

Walsh Re-elected

Richard F. Walsh, incumbent International President, was elected to succeed himself by 644 of the 973 ballots cast. William T. Bennett, of L. U. No. 22, Washington, D. C., polled 296 votes in opposition to Walsh, and Vincent Jacobi, L. U. No. 1, of New York City, received 33 votes.

Harland Holmden, L. U. No. 160, Cleveland, Ohio, was re-elected first vice president with 671 votes against 287 for Russell L. McKnight of Los Angeles L. U. No. 683.

William P. Covert, Toronto L. U. No. 173, beat Arch Prentice of Toronto's No. 58 for second vice president, 599 to 367.

Lou Krouse retained the post of General Secretary-Treasurer, 764 to 192, against Steve D'Inzillo of New York L. U. No. 306.

Others elected were: Floyd M. Billingsley, San Francisco L. U. No. 162, 3rd v-p, unopposed; James J. Brennan, New York L. U. No. 1, 4th v-p, unopposed; Roger M. Kennedy, Detroit L. U. No. 199, 5th v-p, unopposed; Felix D. Snow, Kansas City, Mo., L. U. No. 31, 6th v-p, unopposed; George W. Brayfield, Denver L. U. No. 7, William C. Scanlon, Lynn, Mass., L. U. No. 73 and R. E. Morris, Mobile, Ala., L. U. No. 142, trustees; Thomas V. Green, Newark, N. J. L. U. No. 21 and E. J. Brock, Cleveland L. U. No. 160, delegates to AFL conventions; Edward L. Turner, Winnipeg L. U. No. 299, delegate to the Dominion Trades and Labor Congress.

Constitutional Changes

Changes voted in the Constitution and By-Laws included the following:

Article 2, Section 5, was amended to list the elective officers of the Alliance as President, General Secretary-Treasurer, seven vice presidents, of whom at least one shall be a resident of the Dominion of Canada and affiliated with a Canadian local union; a Board of three trustees, delegates to the AFL and to the Dominion Trades and Labor Congress. Appointive officers are to be an Assistant President and such International Representatives as the President may appoint, of whom at least one shall be a member of a studio local.

Article 13, Section 1, now provides that official bulletins shall be issued and circulated by the General Secretary-Treasurer, that each local union shall receive as many copies as it requests, up to the number of one for each theatre in the local's jurisdiction plus two for the local's office files.

Article 7, Section 2, authorizes the International President to appoint as many International Representatives as he considers necessary, subject to the approval of the General Executive Board. He is to appoint the Election Board at the Convention, subject to the approval of the General Executive Board, and shall appoint delegates to trade assemblages other than the AFL and Dominion Trades and Labor Congress.

Article 9 of the By-Laws provides that any IA member who is unable to collect wages due him may invoke the aid of the General Secretary-Treasurer, and that official, if unable to obtain a satisfactory adjustment, shall report the matter to the President for further action. Such claims must be filed with the General Secretary-Treasurer within 30 days after the wages are due; knowingly filing a false claim subjects the claimant to a fine of Fifty Dollars.

Article 2 of the Constitution receives a new section, Section 6, providing that no person shall be elgible for elective or appointive office of the IA who has not been an active, working member in good standing for at least five years.

A new Section, 28, was added to

Richard F. Walsh
I. A. President

Article Nineteen, limiting initiation fees to four times the highest regular weekly wage scale within the union's jurisdiction.

Article 3, Section 7 of the Constitution now provides that no action of a convention shall be invalid because of lack of quorum, unless the question of the absence of a quorum was raised in advance of the action.

Article 5, Section 2, of the Constitution was amended to read that elective officers shall be elected every two years at a regular convention and shall continue in office until election and installation of their successors, acceptance of resignation or removal by impeachment. Appointed officers shall continue in office until removed by the President or the Executive Board, or acceptance of resignation.

Article 7, Section 8, provides for auditing of the Alliance books by an auditor selected by the President with the approval of the Executive Board, presentation of the audits to each convention for their consideration and action, and payment of the cost of auditing out of the general fund.

Section 26, Article 19, is amended to require that all apprentice members be regularly admitted to full membership or rejected by ballot after not more than three years of apprenticeship or junior membership. This provision must be complied with within three years of the time of its enactment. No local shall be permitted to register more than one junior or apprentice for each five regular members; and in no case more than a total of twenty junior or apprentice members.

Article 7, Section 9, as amended empowers the International President to have the books of any local union audited at the cost of the IA general fund; to select certified public accountants to conduct the audit with the approval of the Executive Board. The reports of the accountants shall be submitted by the President to the Executive Board, and to the delegates of every convention for their consideration and action.

As amended, Article 22, Section 3, declares that the International President may authorize a local union to call a strike, but if more than three theatres are affected the President must have the approval of the Executive Board.

Article 21, Section 12, provides that a member may be suspended or expelled without trial by his local union if he fails to meet his financial obligations to the union for a period of more than six months. Lost dues books must be replaced at a cost to the member of $3.00 for each duplicate dues stamp.

Resolutions adopted called for:

Mobilizing all labor for effective prosecution of the war, formulation of a political program to assure defeat in the coming elections of appeasers and native fascists, and defeat of anti-labor legislation; commending President Green of the AFL and President Murray of the C.I.O. for the initial steps they have taken toward securing labor unity; setting up the principle of vacations with pay as a recognized International policy; placing the IA emblem on all apparatus and equipment used by IA members, the local unions to furnish the emblems; restricting IA membership to citizens of the United States or Canada, or to those who have taken out final Naturalization Papers.

Lou Krouse
IA Secretary-Treasurer

Fred J. Raoul
IA Assistant President

Local 306 Wins Sweeping Victory Over Exhibitor

Sweeping and unqualified victory was won by Local 306, New York City, in the New York Supreme Court in a case in which an exhibitor tried to get out of a contract with the union by charging fraud and misrepresentation, also claiming that there never was a contract anyhow.

Justice William C. Hecht ruled that there was a contract, that there was no fraud or misrepresentation, that the contract is valid and the exhibitor must carry out all its provisions.

The case concerns the Grand Central Newsreel Theatre, owned by David Dubin. In a two-day trial Dubin contended that there was no signed contract with the union, but even if there were one he had been led to enter into it by fraud and misrepresentation on the part of the union; he had been falsely told his theatre was in the Broadway zone; further that some provisions had been removed from the contract without his approval.

Bert Popkin, former business representative of 306, testified to having negotiated the contract with the exhibitor.

Dubin was ordered by the court to carry out all the provisions of the contract until its expiration on September 1, 1946.

Herman Gelber, President of 306, in commenting on the case, said that it would serve as an example, to the small minority of exhibitors who might wish to evade legitimate agreements, of the Union's determination to uphold, through legal action, the validity of its contracts and the integrity of its officers and members.

N. Y.'s State Unemployment Pay Raised to $18 a Week

Unemploment Insurance will mean more to New York State workers after June 1 by virtue of amendments to the New York State Unemployment Insurance Law just enacted.

These amendments reduce the waiting period from three to two weeks, increase the maximum weekly benefit rate from $15 to $18 by adding three additional rate classes, increase the duration of benefits from thirteen to twenty weeks, and provide benefits for partial unemployment. The last change, however, does not become effective until November 30 of this year; the first three go into effect on June 1.

The change in the law is intended to provide more equitable unemployment payments for workers whose normal pay is above $30 a week.

As of April 30th, New York State's Unemployment Insurance Trust Fund totalled more than $317,000,000.

Review Of Projection Fundamentals

III.—Kinds of Conductors

New technical problems will unavoidably be imposed on the projectionist by war conditions. At the same time, he will want to prepare himself for the technical surprises sure to appear when the war ends. In the conviction that our readers will consider the present an ideal time to revive their knowledge of fundamentals, IP here presents the third of a series of articles dealing with the bases of electricity, optics, sound and other foundations of projection room technique.

THERE are four general kinds of conductors of electric current—solids, liquids, gases and vacuum. The action in all is not the same.

The simplest conductor is the vacuum. If a pair of terminals is sealed into a vacuum, if a source of voltage is connected across them, and if emission of electrons from the negative terminal is obtained, the electrons will flow across the vacuum—particles moving through empty space—until they contact the positive electrode. The ohmic resistance of a perfect vacuum is zero; nevertheless there are influences which limit the flow of current in proportion to a given voltage—emission resistance, or the reluctance of the negative terminal to give up electrons, is one of these. Hence a vacuum tube actually has a space or plate resistance, and would have even if its vacuum were so good as to be theoretically perfect.

No tube is perfectly evacuated; in all there remain some traces of gas; gaseous conduction occurs side by side with vacuum conduction in any tube. In most, the percentage of gaseous conduction is so small it can be disregarded; but sometimes through leakage or otherwise a vacuum tube becomes "gassy" and must be taken out of service.

Gaseous conduction is utilized intentionally in many tubes, and it is of course the basis of the projection arc. The action depends on ionization of the gas or gases involved.

Ionized Gases

If the positive and negative terminals above mentioned are separated by a gas, rather than by vacuum, emission of electrons from the negative terminal results in ionization of some molecules or atoms of the gas. The emitted electrons collide with the atoms, removing one or more of the atomic electrons. The remainder of the atom then exhibits a positive charge, and is called a positive ion. It is attracted toward, and drifts to, the negative terminal, at which emission is taking place; and the attraction of its positive charge promotes further emission. Eventually the ion captures one or more slow-moving electrons; returning to its atomic state until it is disrupted again by a new collision. The presence, in the vicinity of the negative terminal, of clouds of positively charged ions, results in a much greater emission of electrons than would otherwise take place under the same conditions; and since the electrons are attracted to the positive plate and constitute a flow of current the increased emission produces a greater flow of the tube current. In other words, the presence of gas in a tube reduces the emission resistance of the tube, resulting in lower "plate resistance."

Gas is used in modern photoelectric cells to produce greater emission in proportion to the amount of light falling on the negative electrode, thus permitting the use of a less sensitive photocell output circuit than would otherwise be required.

Rectifying tubes usually (though not always) are gas-filled, permitting them to handle greater quantities of current and thus making possible the use of smaller tubes.

The projection arc relies entirely on

Local No. 160 Donates Two Ambulances to Cleveland's Civilian Defense

"A SPLENDID, pace-setting example for other civic-minded organizations to follow," were the words with which Mayor Frank L. Lausche, of Cleveland, Ohio, accepted on behalf of his city a gift of two completely-equipped ambulances presented to the police department by Local Union 160, IATSE.

The presentation, made by Harland Holmden, business agent, was accompanied by colorful ceremonies, including a parade from the City Hall to the Public Square. Participating in the parade was L. U. 160's troop of mounted, uniformed police auxiliaries, which was organized 10 years ago. High municipal and civilian defense officials participated, and more than 2,000 of Cleveland's citizens attended the ceremony. In addition to the Mayor, Director of Public Safety Frank D. Celebrezze, Police Chief George J. Matowitz and the civilian defense head, William A. Stinchcomb, represented the City.

The ambulances cost the union approximately $3,000, and are fully equipped for civilian defense work. Each ambulance has single invalid couches, extra stretchers, blankets, medical supply cabinets and first aid kits. They are prominently inscribed with the insignia of the Cleveland Police Department and the words "Civilian Defense Emergency Mobile Patrol." An inscription on a lower panel names the union as the donor.

The gift is the first of its kind in Cleveland's preparations against wartime emergencies, and accordingly was "played up" by Cleveland papers.

One of the ambulances donated to the City of Cleveland by Local Union 160.

gas conduction, the gas being partly air, partly gases given off by the carbons themselves. When the arc is struck the carbons act like the contacts of a switch, closing and then opening a circuit. At the moment of opening the circuit some arcing takes place, as in any switch. In an ordinary switch which has been only slightly opened, so that arcing occurs, copper is quickly burned away until the gap becomes wide enough to open the circuit. But carbon does not burn away as rapidly as copper, and the feed mechanism keeps the carbon tips within pre-determined distance of each other, sustaining the arc. Conduction across the gap is sustained by electrons emitted from the heated negative carbon, and is the same kind as the conduction that takes place in a gas-filled rectifier tube.

Liquid Conductors

Conduction by liquids occurs in every battery, including "dry" batteries—which are not dry. The action is ionic. Ions in this case are not produced by electronic bombardment, but through the mere fact that salts, acids, etc. are dissolved in water. They ionize spontaneously. Water itself is always slightly ionized—but so slightly that perfectly pure water is a poor conductor. Substances dissolved in water, however, may be almost completely ionized, as many as 90 percent of their molecules breaking apart into positively and negatively charged particles. Such solutions constitute excellent conductors. But where the dissolved substance is one that does not ionize appreciably—sugar in water for example—the conductivity of the solution remains slight.

Solid Conductors

Conduction through solids is the kind most commonly encountered. The action is not completely understood. Electrons may move through the spaces between atoms, which are essentially a vacuum, or there may be a progressive ionization of one atom after another, beginning at the negative terminal and proceeding like a relay race toward the positive terminal. Both actions may be present simultaneously in d.c. circuits. Metals, which in general ionize rather readily, make good conductors; on the other hand sulphur, although it can be highly ionized, is one of the best of insulators, and copper, which does not ionize at all at room temperature, is a fair to medium conductor. Moreover copper and silver, metals which show the least tendency to ionize in solution, are the best conductors among the solid metals.

Temperature exercises a marked effect on conductivity in both liquids and solids. In liquids the conductivity rises very roughly 3 to 1 between room temperature and the boiling point of water. Carbon also is a better conductor at high than at low temperatures. The resistance of carbon drops roughly 75 percent between room temperature and the temperature of a low-intensity arc, or of a carbon filament. The metals exhibit the reverse tendency; the resistance of copper increases very roughly 9 to 1 between room temperature and the melting point of the metal. Hence an ohm-meter reading taken on a cold carbon, or on a tube or electric lamp filament in the cold, gives a very poor indication of the resistance of the conductor in question under working conditions.

The metals in fact seem to lose all resistance at extremely low temperatures, hundreds of degrees below zero. If a ring of metal is frozen to that extent and current is induced in it, the current appears to go round and round without dying out or losing strength, apparently encountering no appreciable resistance at all.

Rectifiers

Solids, and some solid-liquid systems, also sometimes exhibit one-way conductivity. Such conductivity is common enough in vacuum and gas conduction, where it forms the basis of rectifiers used in the projection room. In those systems, in which the presence of a current depends on electronic emission, current flow can only take place from the emitting terminal to the non-emitting terminal; if an alternating potential is connected across these terminals current flow can occur only during those intervals when the emitting terminal is negative. In the case of solids and liquid-solid systems, the reason for one-way conduction is not so clear, and cannot always be completely explained. Platinum terminals dipped into nitric acid or supersaturated lye solution will conduct d.c. in either direction, but apparently conduct radio-frequency a.c. in only one direction. Certain crystals, such as carborundum, act the same way. The projection room makes use of copper oxide-copper and copper sulphide-copper all-solid systems, which have the property of conducting d.c. in one direction only.

These combinations serve as practical projection room rectifiers, dealing with very small currents when they are used in a.c. meters, as in decibel meters, with fairly large currents when they are used as arc lamp supply rectifiers. The insulating film in electrolytic condensers, apparently consisting of an aluminum compound deposited on aluminum, is also a unilateral or one-way conductor, connected in practice in such polarity that it serves as an insulator; thus the aluminum and the liquid in which it is immersed become two conductors separated by insulation, and the whole device functions very satisfactorily as a condenser—unless a mistake is made and the polarities of the wires connecting to it are reversed. Unilateral conductivity is among those mysteries of conductivity in solids that still have not been thoroughly cleared up.

Projectionist Devises Carbon Consumption Guide

Walter Dunkelberger, of Local No. 510, Fargo, North Dakota, recently invented a device that indicates carbon consumption at a glance, and without necessity for opening the lamphouse door. He describes his invention as follows:

"Here's a tip to pass on to users of Strong Utility and Simplex High lamps. Recently I hit upon an idea to facilitate the determination of the length of carbon still left in the lamp without opening the lamphouse door. I painted the carbon holder handles, which protrude from the lamphouse, a gloss white. I used a glossy white enamel so that the handles, which are used frequently, could be kept clean easily. Then I moved the handles as close together as they would go, marked the distance between the handles and painted the area with glossy white enamel also. As the carbons burn in the lamp the holders and the handles move toward each other. Therefor the black 'gap' between the handles and the white area indicates the amount of 'burnable' carbon left in each holder. If desired it is very easy to mark off the black area into units such as inches or corresponding to lengths of carbon used in so many minutes or for short and long reels.

"I pass this on in hope that it will save a little time in an already crowded shift in 'one man booths'."

View of white-painted carbon handles, which approach each other as carbons are consumed. The amount of black space between each white handle and the central white band shows how much of each carbon remains.

The Consumption of the Positive Arc Carbon†

By H. G. MacPherson
NATIONAL CARBON COMPANY

The consumption of the positive electrode of an arc between solid carbons in air results partly from evaporation and partly from oxidation. The oxidation is operative chiefly on the sides of the carbon, tapering the end of the electrode and thus producing a tip with a diameter ½ to ⅝ that of the original carbon. The consumption of the flat tip, or crater, however, is due almost entirely to evaporation. The evaporation rate is controlled by the pressure of carbon vapor at the crater surface and the mechanism of diffusion away from it. This was borne out approximately by measurements of consumption rates made near the overload current.

IN AN arc between pure carbon electrodes the crater face of the positive carbon has a remarkably uniform temperature when the arc current is at its maximum for peaceful operation of the arc. This temperature is independent of the size of the positive electrode and can be reproduced at will. The constancy of this temperature has led to the belief that the positive crater of the arc operates at the sublimation temperature of carbon. In an effort to gain some light on this question, an attempt has been made to calculate theoretically the consumption rate of the positive carbon and compare this calculation with measurements.

Fig. 1 is a picture of an arc between solid carbon electrodes. In this case the lower carbon is the positive electrode and is 7 mm in diameter. The upper electrode is 5 mm in diameter and the arc current is about 12 amperes. The negative carbon tapers to a rounded point and is consumed and shaped to this form largely by oxidation of carbon from its sides in combination with some evaporation from the tip. The positive carbon is tapered somewhat on the sides by oxidation, but there is a flat tip or crater that is consumed almost entirely by evaporation. The consumption rate calculation was based on an assumed operating temperature of 3950°K, a density of 1.62 corresponding to graphite electrodes, and a vapor pressure of carbon of one atmosphere. This calculation is plotted as the diagonal straight line of Fig. 2.

Also shown in Fig. 2 are measurements made on a large number of arcs using positive carbons with original diameters of 1/16 to ⅜ inch. Some of the points represent arcs in which the positive carbon was used as the lower electrode and others in which the positive was the upper electrode, and both amorphous carbon and graphite electrodes are represented. The arcs were run at a current just below overload, and the consumption and final crater diameter measured. The consumption rates varied from about 3 to 28 inches per hour in the range of carbons used. The measurements confirm the prediction that the consumption rate should vary inversely as the crater diameter. The actual consumptions found are on the average about 30 per cent lower than those calculated. This must be considered a fortuitously close fit, considering the approximate measurements and the uncertainty in the calculations.

Certainty of Calculations

These uncertainties in the calculations should be pointed out. In the first place, it is assumed that the carbon burns with a hemispherical tip instead of a flat tip. This assumption would lead to a high value for the calculated consumption. It was further assumed that the carbon vapor diffuses only throughout one hemisphere instead of in all directions. This probably tends to produce too low a value for the calculated consumption, although the carbon oxidized and evaporated from the tapered sides will prevent downward diffusion to some extent. Furthermore, the extrapolation of the diffusion constant to a new gas at an extremely high temperature is somewhat uncertain. The temperature of the gas in which the diffusion takes place is not uniform, but is higher than the assumed value within the arc stream and is lower than this value at some distance to the sides of the arc.

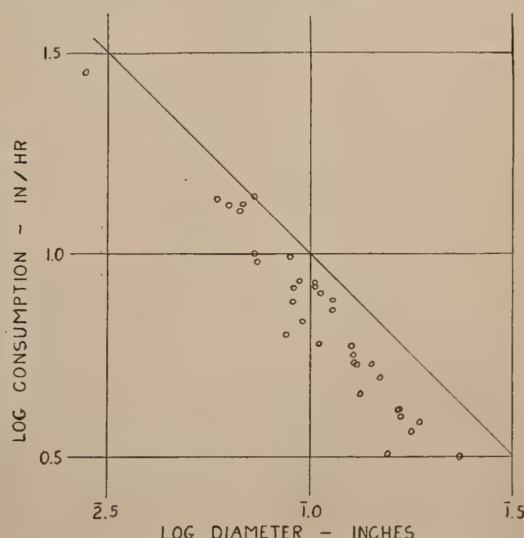
In view of these approximations in

(*Continued on page 25*)

† J. Soc. Mot. Pict. Eng.

Fig. 1 (left) Arc between small, solid carbons.

Fig. 2 (right) Carbon consumption, calculated and measured.



Highlights of the IA Convention

By HARRY SHERMAN

MEMORIAL HALL in Columbus, Ohio was gaily decorated with American and Canadian flags; the American Legion band played many popular songs while the delegates strolled in leisurely to be seated for the 36th convention. The boys often joined in with their loud singing, and the band received a big hand from the 950-odd merry-making delegates who were here for serious business.

● When order was called Larry Buck, President of the Columbus Stage Hands Union No. 12, opened an I.A. convention for the second time. The first occasion was in this same city in 1932. Incidentally, Larry was appointed President of this local by the writer about 15 years ago, and he is still at it. Good luck, Larry, you have proven yourself a good choice.

● Before any I.A. convention opens officially for business, a slew of speakers appear on the platform for the welcoming chores, and this one was no exception. First they heard from Mayor Green, who had them in stitches. He in fact even offered to serve out any term in the "City Hotel" with any delegate who should be unfortunate enough to get such a sentence from a City Magistrate. His welcoming address was loudly cheered.

● Throughout the morning Lincoln, Napoleon and the "little corporal" (a. hitler) were mentioned, but not in the same breath, thank God.

● Divine blessings were invoked by Rev. Thomas Sabrey of St. Joseph's Cathedral, Columbus, Chaplain Price of the U. S. Army, and Rabbi Tarshish.

● At this time Dick Walsh took over. He was very calm and received a thunderous ovation. His is a Horatio Alger tale; from apprentice to International President in less than a generation.

● In the afternoon session, Vice President Harland Holmden introduced Senator Harold Burton of Ohio. The senator was late in arriving because of Lord Halifax, but the delegates did not mind that for they went next door to the Elks Club and partook of conversation and refreshments at the bar.

● Secretary - Treasurer Lou Krouse looked immaculate on the rostrum when the roll call of the seated delegates to this convention took place. His cigar was not in evidence.

● Four members of the New York Projectionists Union No. 306 were appointed to committees. They were Joe Basson, Charlie Beckman, Nat Doragoff and Herman Gelber, the President of the local.

● William Green, President of the A. F. of L., spoke long and at times loud. Bill is beginning to show his age, and which of us is not, I ask? Oh where is that youth we once had?

● When Prexy Walsh took his place to read his report, he showed signs of nervousness. During the reading of it he drank much water, and the delegates were all attention. When he finished, the entire floor semed to have been pushed up for everyone was on his feet yelling, cheering and some were crying. You could have heard this ovation over in Springfield, Ohio. It lasted for quite a spell until stopped by Dick himself. He was all smiles, and so was every member of the official family, both on and off the rostrum.

● Dick Walsh displayed much of the Irish wit he is full of when a delegate asked that two members of his local No. 659 of Hollywood, who are officers in the air force be introduced to the convention. These men were not delegated but were here only on a visit. Dick asked them to appear on the platform and they received a tumultous reception. They were introduced as Captain Whitley and Major Newhard. They both thanked the delegation and spoke briefly. At this point Dick pulled one that had everyone in the aisles. "Do you notice how calm and gentle they are when not giving orders?"

Harry Sherman

● The delegation of New York Stage Hands No. 1 arrived on a day coach from New York in all that heat. It was a gruelling trip on the Pennsy. At least they tried conserving according to the National Defense by giving up their sleepers to soldiers and sailors. Ouch!

● Smiling Lou Kaufman of Newark Projectionists No. 244, the man who gives you a laugh a minute and is the life of every party. Neatest dressed man at the convention. Lou pulled a humdinger when passing the "City Hotel".

● The ever ebullient Steve Newman was around in all spots, including the wrestling match. Genial Steve, known to the writer for over 25 years, still looks like the good looking dandy of 1916, when he was running around with Les Dolliver, except for his pot-belly. March on, Steve.

● At this time we must not forget the swell job turned in by a comparative youngster, Bob Greer, President of the Columbus Local No. 386. He was in his glory, and a capable kid is he too. Not only is he good looking but a swell host.

● Max Ealey of Wichita Falls, Texas, Local No. 378, one of the fat boys appearing in a very nicely fitted brown sport suit which made him look fatter than ever, showed up with his very broad smile and the Texas delegation.

● Bill Kunzman of the National Carbon Company was also in evidence at this convention. Bill has been going to conventions (all sorts) ever since he was a salesman for his company. He knew practically everyone there. He had with him Erwin Geib, also of National Carbon, who delivered a lecture on their

Victory Carbons. This writer, who attended the lecture, was agreeably surprised when over 600 delegates put in an appearance. That proves that the men are eager for knowledge, and they will benefit by reading and subscribing to the INTERNATIONAL PROJECTIONIST. (My first opportunity for a commercial).

● Orin M. Jacobson, International Representative of the West coast, known to all as "Jake", also secretary of the First District, looks about 30 years of age. Writer has known him to be a projectionist for over 30 years, but he shows not his age. He is the calm baby of the official family.

● Solly Pernick, Business Agent of the New York Stage Hands Local No. 1, was the most dynamic personality at the convention. A very good mixer and here to "buy" for Local No. 1. He never tires; was a frequent visitor to Esther's with the boys out for a good time, and knows how to throw ice too. A host to many delegates, buying good will for his local.

● Oscar Moody, of Local 433, Davenport, Moline and Rock Island, Ill., the onion center of the United States. He is still "Shorty" to the writer and a personal friend of long standing. Oscar knows his onions and is a capable projectionist.

● Sam Goldfarb, of the New York Stage Hands Local No. 1, refused to attend the horse races at Beulah Park. 'Tis said that Sam still has that famous dollar, and he did object vociferously when Louis Yeager, his co-delegate, visited the race track instead of attending a local caucus. Sam certainly had Louis "nuts".

● Herman Gelber, President of the biggest local in the Alliance, New York Projectionists Local No. 306, arrived Saturday afternoon. His co-delegates thought he was walking in from New York. Herman kept to himself most of the time; guess too much worry of the state on his broad shoulders. Had a pleasant conversation with the writer for about three hours. Good luck Herman, hope you succeed in the efforts you told me about.

● The ever smiling Canadian Vice President, Bill Covert, the oldest Vice President in existence, showed the writer a picture taken 22 years ago at the Kingston, Canada, convention when we both had black hair. On that picture were Charlie Shay, Bill McKinnon, Lou Krouse, Joe Magnolia, Charlie Davidson, Charlie O'Donnell, Frank Lemester, Bill Dillon, Dan Carey of the Musicians, Pat Ryan, George Jones, Red Malcolmson and Oscar Cook. The only change, besides those that have passed on to the great beyond, is that the writer's hair is grey and thin, while Covert's is not there at all. Such pictures certainly bring back fond memories.

● Bill Ayers, of Toronto Projectionists No. 173, assistant to Bill Covert up there, was the wittiest man at the Canadian delegation (he was named the "Visiting Fireman" at the Los Angeles convention in 1930). He was around the lobby of the Neil House telling his funny stories, and had the delegation hilariously laughing until they practically split their sides.

● James F. Morgan of Portland Local No. 28, was very busy running around from place to place with his partners Harry Cassidy of Portland, Ore., and K. R. Gingerich of Walla Walla, Wash., begging for a bit of sleep. What these old timers can do, the youngsters will have to learn much about.

● N. L. Liggett, Sr., of Atlanta Local No. 225, co-delegate of Assistant President W. P. Raoul, showed up with Mrs. Liggett. He is a swell host and regular fellow, while Mrs. Liggett is a beautiful doll with a lovely sense of humor. She was disturbed about her Pekinese having pups and her sister-in-law having a baby. Hope they both delivered, Mrs. Liggett. You and your husband are hosts of the first water, but keep away from the Variety Club.

● The 4th District meeting was held under the able leadership of Lou Krouse and Sec. Lawrence Katz. The writer addressed this meeting and found that it went to town in real parliamentarian fashion. These boys all seem to know their business well, and all matters pertaining to the best interests of the locals in that district were handled very nicely.

● Howard Jackson of Omaha, Neb., Local 343, a real old timer and a treat for sore eyes to the writer, also showed up with Mrs. Jackson. Here is a real dandy couple. Both brought up in show business. No see them for about 15 years and a happy reunion took place. Not much change here, but for the avoirdupois.

● Joe Monaco of Westchester No. 366. Called by everyone "Ticklish Joe," and can take more "punishment" than any other man anywhere, always coming up with a smile and a ditty. Joe really can do a powder puff number like nobody else. How come you had a sore jaw for a few days, Joe?

● Arthur Martens of Westchester No. 650. "Smiling Artie" he is called by his friends. Spent a few weeks before the convention building up for it at Magnetic Springs, Ohio, with Dick Hayes his co-delegate and Bobbie Anstett, former president of N. Y. Local No. 1. "Look out for your diabetes" says he to the writer and vice versa. We both handled it carefully, eh?

● P. A. McGuire, known to everyone as "Mac," advertising manager for the International Projector Corp. Here on serious business, this time however NOT selling projectors. Addressed all district meetings in an able manner on the subject of conservation. Most serious minded man here and what a man! He was all over the place and is the best advertising and publicity man in the business. Friendly to all and loved by all. Mac is an honorary member of the 25-30 Club of New York Projectionists and various I.A. locals throughout the country.

● Thad Barrows of Boston Projectionists No. 182, another "permanent" delegate. Thad has the finest sense of humor known to the writer. Proof of same was the picture he mailed to a certain party in New York from Kansas City on his trip to the west coast. Ask Thad when you see him, especially you Boston boys. Thad has been president of Local 182 for over 25 years. Keep it up Thad, between you and Jimmie Burke there is no better combination of President and Business Agent anywhere in the Alliance.

● Art Humphries and Kermit Lewis of Sioux Falls, South Dakota. A spot in my heart. A grand city to reside in and the people are wonderful too. The boys here with their wives, who were having the time of their lives. Art was projectionist for the writer several years ago in Sioux Falls, and a good one at that. I promise to pay you folks a visit as soon as it is possible to do so. We certainly had a fine time at dinner, eh?

● W. R. Tinney of Laredo Local No. 678. The champion candy eater of the world, and right hand man of Ayala, whose plan to make a merger between the Mexicans and the Americans has already been started. Good luck, Tinney.

● Linford Risley, of Brooklyn Local No. 4, a former partner of Dick Walsh in the days gone by. Known to the

Delegates were shocked and saddened when President Walsh interrupted proceedings to announce that Fred Raoul's mother died that morning, necessitating Raoul's departure for Atlanta to attend the funeral. In spite of that heartbreaking experience, Raoul returned to the convention on Thursday to help his associates through the grueling election contest.

writer as "Len," and liked by every member of Local No. 4. Guess Len would have loved to have Dave Berk with him this time. Dave is a former president of Local No. 4.

● Charles Hathaway of Tulsa Local No. 513, and President of the Oklahoma State Federation of Labor. A slow talker but a fast thinker; a loyal and faithful friend to have at all times. The Masonic stand-by of Oklahoma. (Thanks loads, Charlie).

● Bill Elliott of Cincinnati Local No. 5, a former International President, rose to heights in oratory when he declined the nomination to run against his friend, Lou Krouse. Bill was given a rousing ovation when he sat down. He is as rotund as ever, ever smiling and still plays the horses. Who remembers when Bill played ball with the Chicago Cubs?

● Rabbi Tarshish, who has addressed the past four or five conventions. Man, can he orate! Every word extemporaneous and to the point. You could have heard a pin drop during his oration. When he concluded, all the delegates jumped to their feet cheering and yelling loud and long. May he perform at many more conventions.

● Bill Donnelly of the Minneapolis Stage Hands Local No. 13, was the hottest man in Columbus. Whenever Bill was spotted, he sat at his table wiping the perspiration from his brow, and laughing when he thought of the blizzards that visit Minneapolis. Bill and the writer have had many a tussle in years gone by, but that is all forgotten now.

● Jimmy Brennan, 4th Vee Pee of the I.A. A small man with a big voice. Jim needed no microphone to make his announcements. He received a very big hand when it became apparent that he would have no opposition during the election.

● Lou Krouse, with the ever present cigar in his mouth or hand, was the BUSIEST man at the convention, both at the hall and in the hotel. One could not speak for more than two minutes to him, when he would be pulled away for other matters of state. Had to remain up all night signing checks for the delegates so that they could return home, and did a wise thing by arranging with the bank to remain open until 6 P.M., so all delegates could have their checks cashed. He was all smiles after the election and when presented with a wrist watch from the 4th district, nearly swooned—he was that flabbergasted. He's been in service only a little over 25 years, and well does the writer remember when he was the cause of our becoming a member of the official family, too long ago. Lou, you made me a promise, so you had better keep it.

● Floyd Billingsley, Second Vee Pee of the I.A., the first man to be unopposed during the nominations. Called the "King" of the First District, and adored by every delegate there, especially Tony Noriega of the same San Francisco Local No. 162. Sometimes his cigar looks a bit bigger than he is, but he has not forgotten his Austin, Texas, drawl yet. His smile is ever present.

● Harland Holmden of the Cleveland Projectionists No. 160. The aristocratic looker of the official family, and holder of a great responsibility. He seemed very tired at times, and really appreciated the few moments he had in an easy chair in the lobby of the Neil House. But he was never there for long—always being yanked away for some session or other. In another article appearing in this edition of IP you may learn how this man presented through his local two fully equipped ambulances to the City of Cleveland.

● Roger Kennedy, Fifth Vee Pee of Detroit Projectionists No. 199, the 2-tone sport suit wearer looking like a cool million dollars. Another Vee Pee without opposition; he has earned his spurs. Reference:—Ruben, Kirby, Kinsora, Murtagh and Light, all of Detroit.

● Eddie Miller of the Houston Projectionists No. 279, and Int. Rep. of the I.A. in Texas territory. Father of the famous Universal Picture Star, Nan Gray, and father-in-law of that famous jockey, Jack Westrope, who rides B. B. Mayer's horses. Unfortunately, Westrope sustained a broken ankle during the convention, and poor old Eddie al-

(*Continued on page* 22)

Tomsen of L.U. 143 Warns of Misassignment of IA Members by the Armed Services

ROBERT TOMSEN, business representative of St. Louis Local No. 143, calls attention to the importance of informing all IA members that there are many jobs in the armed forces for which IA men are specially fitted by training and experience, and that by applying for such assignments members will render a service both to the country and to the IA. Tomsen's analysis of this matter should prove of strong interest to all projectionists who expect that they may join the uniformed forces of the nation before this war is over. His article on the subject follows:

At the recent convention of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators, held in Columbus, Ohio, June 1 to 5, inclusive, 1942, the importance of the motion picture as a morale builder and also as a medium of visual education of our Armed Forces was stressed.

From our experiences in the First World War, we learned that the majority of Alliance members in the Service were assigned to work about which they knew nothing, and that subsequently they were never able to be reassigned to the work they were especially trained and qualified to perform, and which is covered by the jurisdiction of the International Alliance.

At our Convention, all Local and International Officers were urged to acquaint all members of the International Alliance entering the Armed Forces with the fact that there are many jobs covered by our jurisdiction which can be obtained by our members making application for them, thus rendering a service to our country and our Alliance.

Our Government has a huge fortune invested in both equipment and films, and as replacements are almost impossible to obtain, the experienced mechanic and operator can be of inestimable value in putting on a first-class show and in prolonging the life of the equipment.

As a general rule, members of the Armed Forces assigned to this class of work are given additional pay and promotions.

The post-war problems of our craft can best be solved, for the individual and the industry, by the proper placement of our skilled mechanics and operators, thus precluding the possibility of flooding the industry with the product of the army schools.

Every Local Union should feel that it has assumed a moral obligation to see that all its members entering the Armed Forces are restored to their former places of employment after the war, and the very best insurance that this can and will be done is to help see that its members entering the Armed Forces apply for and are assigned to the work for which they are so well-suited and trained and in which they will be of most value to our country during the present emergency and to their Local Unions and the International Alliance during the period of readjustment which will necessarily follow the termination of hostilities.

Underwriters Code As It Affects Projection Rooms

Every projectionist knows that his equipment and operations, and any changes he may make in his equipment, must meet the Fire Underwriters' requirements. How many projectionists know what those requirements are in detail? IP will reprint from time to time portions of the National Electrical Code that are important to the projection room, and amendments to the Code as they are issued. Herewith is presented the third installment, with some of the definitions and wiring rules that will be needed for understanding subsequent installments. IP welcomes inquiries on practical application of the Code to projection room problems.

III.

Grounding Conductor: A conductor which is used to connect the equipment or wiring system with a grounding electrode or electrodes.

Hoistway: A hoistway is any shaftway, hatchway, well-hole, or other vertical opening or space in which an elevator or dumbwaiter is designed to operate.

Isolated: Not readily accessible to persons unless special means for access are used.

Isolated Plant: A private electrical installation deriving energy from its own generator driven by a prime mover.

Lighting Outlet: An outlet intended for the direct connection of a lampholder, a lighting fixture or a pendent cord terminating in a lampholder.

Location:

Dry Location: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.

Damp Location: A location subject to a moderate degree of moisture, such as some basements, some barns, some cold storage warehouses, and the like.

Isolating Switch: A switch intended for isolating a circuit from its source of power. It is to be operated only when the circuit has been opened by some other means.

Motor-Circuit Switch: A switch, rated in horsepower, capable of interrupting the maximum operating overload current of a motor of the same horsepower as the switch at the rated voltage.

Switchboard: A large single panel, frame, or assembly of panels, on which are mounted, on the face or back or both, switches, overcurrent and other protective devices, buses, and usually instruments. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets. (See Panelboard.)

System Ground Conductor: An auxiliary, well grounded conductor used for connecting together the individual grounding conductors throughout a given area, but which is not a part of a circuit wire.

Totally Enclosed Motor: A motor which is so completely enclosed by integral or auxiliary covers as to practically prevent the circulation of air through the interior. Such a motor is not necessarily air-tight.

Vaportight: So enclosed that vapor will not enter the enclosure.

Ventilated: Provided with a means to permit circulation of the air sufficiently to remove an excess of heat, fumes or vapors.

Voltage (of a circuit): The greatest effective difference of potential between any two conductors of the circuit concerned.

On various systems such as 3-phase 4-wire, single phase 3-wire and 3-wire direct current, there may be various circuits of various voltages.

Voltage to Ground: In grounded circuits, the voltage between the given conductor and that point or conductor of the circuit which is grounded; in ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit.

Waterproof: So constructed or protected that moisture will not interfere with its successful operation.

Watertight: So constructed that moisture will not enter the enclosing case.

Weatherproof: So constructed or protected that exposure to the weather will not interfere with its successful operation.

Article 110—General

1101. *Approval.* The conductors and equipment required or permitted by this code shall be acceptable only if approved. See definition of "Approved".

1102. *Wiring Methods.* Only wiring methods recognized as suitable are included in this code. Special types of wiring may be used only where recognized as suitable under this and other articles of this code. The recognized methods of wiring may be installed in any type of building or occupancy except as otherwise provided in this code.

1103. *Mandatory and Advisory Rules.* Mandatory rules of this code are characterized by the use of the word "shall." Advisory rules are characterized by the use of the word "should," or are stated as recommendations of that which is advised but not required.

1104. *Special Chapters Amendatory of General Rules.* The provisions of Chapters 5, 6 and 7 of this code are supplementary to, or amendatory of, the general provisions of Chapters 1 to 4, inclusive, and the latter apply under such circumstances except as so amended for particular conditions.

1105. *Mechanical Execution of Work.* Electrical equipment shall be installed in a neat and workmanlike manner and all unnecessary and complicated wiring avoided where practicable. Conductors, raceways, and equipment shall be carefully secured in place and attached to fittings.

1106. *Mounting of Equipment.* Electrical equipment shall be firmly secured to the surface on which it is mounted. Wooden plugs driven into holes in masonry, concrete, plaster or similar materials shall not be depended on for security.

1107. *Voltages.* Throughout this code the voltage considered shall be that at which the circuit operates, whether the current is supplied by a battery, generator, transformer, or rectifier.

1108. *Conductor Gauges.* Conductor sizes are given in American Wire Gauge (AWG).

1109. *Copper Conductors.* Where conductor sizes are given in this code they shall apply to copper conductors of 98 per cent conductivity. If other materials

are used the size shall be changed accordingly. See section 3006.

1110. *Light and Power from Railway Conductors.* Circuits for lighting and power shall not be connected to any system containing trolley wires with a ground return, except in electric railway cars, car houses, power houses, or passenger and freight stations operated in connection with electric railways.

1111. *Working Space About Electrical Equipment.* Suitable working space shall be provided and maintained about all electrical equipment.

a. Horizontal Dimensions. Except as elsewhere required or permitted in this code, the horizontal dimensions of the working space in front of live parts, operating at not more than 600 volts, which must be handled while alive, shall not be less than:

1. For parts of more than 150 volts to ground on one side of the working space and no bare live or grounded parts on the other side of the working space, 2½ feet.

2. For parts of more than 150 volts to ground on one side of the working space and bare live or grounded parts on the other side of the working space, 4 feet.

3. For parts of 150 volts or less to ground on one side of the working space and no bare live or grounded parts on the other side of the working space, 1½ feet.

4. For parts of 150 volts or less to ground on one side of the working space and bare live or grounded parts on the other side of the working space, 2½ feet.

For higher voltages, See Article 710.[1]

b. Clear Spaces. Working spaces adjacent to exposed live parts shall not be used as passageways.

c. Elevation of Equipment. The elevation of the equipment at least 8 feet above ordinarily accessible working platforms usually affords protection at least equivalent to that provided by the horizontal clearances of paragraph a and may be used in lieu thereof.

1112. *Guarding of Live Parts.* Except as elsewhere required or permitted by this code, exposed live parts of electrical equipment operating at 50 volts or more shall be guarded against accidental contact by enclosure or by locating the equipment as follows:

a. In a room or enclosure which is accessible only to qualified persons;

b. On a suitable balcony, gallery, or platform, so elevated and arranged as to exclude unqualified persons;

c. Elevated 8 feet or more above the floor.

d. So that it will be protected by a guard rail if the equipment operates at 600 volts or less.

For motors see section 4432.[1]

1113. *Enclosure of Arcing Parts.* Parts of electrical equipment, other than motors or generators, which in ordinary operation produce arcs, sparks, flames or molten metal, shall be enclosed unless separated and isolated from all combustible material.

1114. *Interrupting Capacity.* Devices intended to break current shall have an interrupting capacity sufficient for the voltage employed and for the current which must be interrupted.

1115. *General Plan of Investigation.* Materials, devices, fittings, apparatus, and appliances designed for use under this code shall be judged chiefly with reference to the following considerations which also determine the classification by types, sizes, voltages, current capacities, and specific uses:

a. Suitability for installation and use in conformity with the provisions of this code.

b. Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided.

c. Electrical insulation.

d. Heating effects under normal conditions of use and also under abnormal conditions liable to arise in service.

e. Arcing effects.

1116. *Connections to Terminals.* Connection of conductors to terminal parts shall insure a thoroughly good connection without damaging the conductors and shall be made by means of pressure connectors (including set screw type), solder lugs, or splices to flexible leads either soldered, brazed or welded, except that No. 8 or smaller solid conductors and No. 10 or smaller stranded conductors may be connected by means of clamps or screws with terminal plates having upturned lugs. Terminals for more than one conductor shall be of a type approved for the purpose.

1117. *Marking.* The maker's name, trademark, or other identification symbol shall be placed on all electrical equipment. Other markings shall be provided giving voltage, current, wattage, or other ratings as are prescribed elsewhere in this code.

Chapter 2. Wiring Design and Protection

Article 200—Polarity Identification of Systems and Circuits

2001. *General.* All interior wiring systems, except as provided in sections 2007, 2512, 2514, 2515, 2516 and 2517 shall have a grounded conductor which is continuously identified throughout the system, except as permitted by paragraph b of section 2005.

2002. *Connection to Grounded System.* No interior wiring shall be electrically connected to a supply system unless the latter contains, for any grounded conductor of the interior system, a corresponding conductor which is grounded.

2003. *Circuits Derived from Auto-Transformers.* Wiring systems and circuits derived from transformers in which part of the turns are common to both primary and secondary circuits, ordinarily known as auto-transformers, shall not be permitted for any interior wiring system unless the system supplied contains an identified grounded conductor which is solidly connected to a similar identified grounded conductor of the system supplying the auto-transformers. See section 4508 regarding use of auto-transformers.

2004. *Connections to Screw-Shells.* An identified conductor, if run to a lampholder, shall be connected to the screw-shell.

2005. *Means of Identification of Conductors.* Identification for conductors shall be secured as follows:

a. Insulated conductors of No. 6 or smaller, except conductors of the weatherproof type, shall have an outer identification as specified in paragraph c of section 93001.

b. Insulated conductors larger than No. 6, and weatherproof conductors of all sizes if used indoors, shall have an outer identification as specified in paragraph c of section 93001, or shall be identified by distinctive marking at terminals during process of installation.

c. Flexible cords shall be identified as provided in section 4013.

d. Terminals of devices shall be identified as provided in section 2008.

2006. *Identified Conductor in Identified Circuits Only.* Conductors having white or natural-gray covering shall not be used other than as conductors for which identification is required by section 2001, except under the following conditions:

a. Identified conductors, rendered permanently unidentified by painting or other effective means at each outlet where the conductors are visible and accessible, may be used as unidentified conductors.

The foregoing permits the use of two-wire cable having one black and one white conductor on 2-wire circuits tapped from the outside legs of a 3-wire system or any two conductors of a multi-wire system if the identified conductor of the two-wire cable is rendered permanently unidentified at terminals.

b. Cable containing an identified conductor may be used for single-pole, three-way or four-way switch loops if

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[1]To be printed in a subsequent installment.—Ed.

Some New Routine Precautions in the Maintenance of Amplifiers

By LEROY CHADBOURNE

UNDER present conditions some accepted routine procedures in caring for amplifiers will have to be changed, and new ones substituted. Component parts which in the past were merely discarded and replaced, will now with increasing frequency have to be repaired and kept in service. Parts so inexpensive that their deterioration was in the past mainly ignored, since their replacement was both inexpensive and easy, now will have to be watched and nursed along. The whole amplifier will need more careful watching, prompter and more thorough attention at the first signs of anything beginning to go even slightly wrong.

Those amplifier components that need greatest attention are of course the ones which are most likely to deteriorate. These usually are tubes, condensers, volume controls and (in some amplifiers) sockets. Two factors external to the amplifier which need plenty of watching are the line voltage and the volume of operation.

More time will have to be spent watching and caring for the amplifier, as well as other items of projection room equipment; and since there is a limit to the amount of work a projection crew can do during show time and still put on a good show, more work will have to be put in after hours.

Further, since it will be necessary to get into the guts of an amplifier more often and more thoroughly than in the past, the stock of projection room appliances for testing and repair work should be replenished *now*, while supply houses and retailers still have needed items in stock and can supply them promptly.

Tubes

Tubes not only deteriorate in themselves, but there are two different ways in which, by failing, they can endanger or destroy other parts of the amplifier, making very serious repairs necessary.

A tube may become gassy. When this happens, its internal resistance lowers—therefore it permits more current to flow at the normal plate voltage. The plate circuit of the tube is connected in series with other amplifier components; when excessive current flows through a tube because the tube has become gassy, excessive current will also flow through all components in series with that tube. Some of them may be burnt out in consequence.

A tube that has become gassy always gives warning in at least one way, often in two ways. The infallible indication is an increase in plate current. Additionally, if the tube is of the glass type, it will show a blue glow which sometimes fluctuates at high volume. However, some types of tube *glass* normally show a blue glow which is on the inner surface of the glass, not in the interior of the tube; this condition, especially if it is not associated with abnormally high plate current, should not be mistaken for an indication of gassiness.

There are two different conditions that lead to a tube becoming gassy. One is a slow leak, permitting outside air to penetrate into the vacuum. Where this condition exists the deterioration of the vacuum will be progressive, and the tube must be discarded at once. More commonly, gas in a tube does not indicate a leak, but emergence into the vacuum of adsorbed gasses which somehow were not removed from the internal elements at the time the tube was made.

Metals, and even glass, are to a limited extent "porous" to the ordinary gases of the air. A moderately accurate comparison would be to think of a piece of metal in air as somewhat similar to a piece of cloth in water. If the cloth has been in water, it has soaked up water; if it is then removed from the liquid and very thoroughly wrung out there will still be some water in its fibers—similarly, when a piece of metal is removed from air and placed in a vacuum and the vacuum is very thoroughly pumped out, there will still be some air trapped in the pores of the metal.

To get rid of that air, water vapor and other gas, tube manufacturers use two devices, in addition to pumping. They heat the parts to a very high temperature while the tube is on the pump, thus driving adsorbed gases out of the metal into the vacuum, where the pump can remove them. Secondly, they explode a "getter" which deposits on the glass as a silvery layer. Some of the residual gas is trapped physically under the silvery layer, some unites chemically with the "getter" at the moment of explosion. In spite of all these precautions, and others involved in an "aging" process after the vacuum has been sealed, the theatre occasionally receives a tube in which there remains some adsorbed gas that will be given off by the elements after prolonged high-temperature operation.

Such a tube is not necessarily dangerous. Gassy amplifier tubes of course should not be used, but if there is going to be serious difficulty about getting replacements, a gassy tube will at least keep the show going, even at some sacrifice of quality—*provided* its condition is due to escape of adsorbed gas from its internal elements. If on the other hand the condition is caused by a leak, then that tube will not keep the show going; not very long. It will in all probability burn out the amplifier.

To distinguish between the two types of gassiness, watch the plate current meter. If there is a leak the fault is progressive, and plate current will not only rise above normal, but will continue to rise. Remove such a tube promptly, before the current gets high enough to cause a burn-out. On the other hand, if the plate current reaches some safe level above normal and then rises no further, the condition is not due to a leak, and in an emergency that tube may be kept in service pending arrival of a replacement.

Gassiness is one of the two ways in which tube faults can endanger other portions of the amplifier. The other, limited to larger tubes of certain types, is failure of filament springs to function as intended. These springs operate to take up the slack in the filament which naturally results from expansion of the metal when heated. These springs cannot be made too strong, or they would prevent the filament from contracting when it cools, and thus tend to tear it. Their tension is a matter of delicate adjustment; and they are exposed to very high temperatures. Naturally they do, sometimes, tend to lose their tension, especially after prolonged use.

If these springs lose their tension the slack that is created when the filament

gets hot will not be taken up. Now, the filament is negatively charged, the plate of the tube carries a strong positive charge—positive and negative attract each other; any slack in the filament will not sag, it will tend to swell outward in the direction of the plate. In consequence the filament may touch the grid. When this happens the grid bias is destroyed; being in direct contact with the filament the grid takes on the same voltage as the filament. But the grid bias operates to hold down the flow of the current through the tube. When that bias is destroyed a strong surge of plate current follows instantly, burning out the tube, or amplifier units in series with the tube, or both, depending on the design of the circuit and other details.

In tubes of the type referred to, the action of the filament springs can best be observed when the equipment is first switched on in the morning. The tube has had all night to cool. The springs are expanded as much as they ever will be. As the filament heats up the contraction of the springs will be clearly visible to a projectionist who is carefully watching for it.

But there may be several tubes in the projection room of this spring-filament-mounting type, all of which will heat up together, but all of which cannot be watched simultaneously. It is desirable, therefore, to set up a simple routine, numbering all such tubes 1, 2, 3, 4, etc., and to watch the springs of Tube 1 when opening on Monday morning, the springs of Tube 2 on Tuesday morning, and so on. These springs practically never deteriorate without warning. They lose their tension, if they lose it at all, rather slowly as a result of the continued high temperature to which they are subjected, and if each individual tube is observed every four or six days, any growing reluctance of its springs to function properly will be caught in time.

If there is doubt about the spring action in any tube, replace the tube the instant a new one can be obtained, and make every effort to get one promptly, remembering that defective spring action can destroy not the tube alone, but in all probability the amplifier also.

Condensers

Condensers of several types of construction are used in the projection room. The majority of them go on for years without giving any trouble. But in every amplifier there are condensers which are connected directly across the highest voltage in the amplifier circuits. Breakdown of a condenser so located constitutes a short-circuit of the high voltage wiring, with a practical certainty of serious damage (unless the individual condenser is fused) and a fair probability that the power transformer will be among the parts that are destroyed.

One fair warning given by condensers which are weakening is an increase in the background hum (line frequency hum) of the amplifier. If there is line frequency hum in the sound that is audible at all, and if it grows progressively stronger with time, no matter how slowly, suspect the amplifier filter condensers. If temporary replacement of these condensers with new ones reduces the hum, play safe—don't put the old condensers back in service.

Some amplifiers still used in projection rooms have condensers that are insulated in tarry or pitch compounds, which black stuff sometimes oozes out of the condenser case under the heat of amplifier operation. When this happens some of the insulation protecting that condenser against breakdown has oozed to where it can no longer serve as protection. Replace such condensers at the earliest possible moment.

In ordering replacement condensers, ask the manufacturer of the equipment or other supplier for the same capacitance with (if practicable) a still higher voltage rating—i.e., higher safety factor. The higher the voltage rating, the more expensive the condenser, and the price sometimes climbs rather steeply. But you don't know how long a condenser you get now may have to last you.

Small condensers used in amplifier circuits, and so located that they are unlikely to puncture, or to cause any serious damage if they do, occasionally become noisy, giving rise to paper-crackling interference in the sound. If you *know* the condenser to be so located in the circuit that its complete breakdown can do no serious harm, the noise may be temporarily tolerated as merely constituting poor sound, which is highly undersirable but not a danger. However, a small condenser may also be so located in the circuit that the amplifier will be seriously damaged if the condenser gives way completely. Therefore any crackling, paper-tearing interference should be investigated promptly and thoroughly and run down to its ultimate source; if that source is a condenser "acting up" study the circuit. It may be possible to remove the condenser entirely with no harm except some change in sound quality, whereas leaving it connected may invite a short-circuit. Obviously in that case, the thing to do is to remove it.

Volume Controls, Etc.

Volume controls are among those portions of an amplifier which are subject to deterioration because of mechanical wear. Some types break down rather thoroughly in time, becoming first extremely noisy when adjusted, and then open-circuiting entirely in certain positions.

Because the volume controls used in modern amplifiers are inexpensive types, there has recently grown up a tendency not to pay too much attention to them; but to let them deterioriate and when they get too poor, put in a new one. Today, when the new one may not be easily or quickly obtainable, the existing control may have to be "babied" as never before. This may involve very careful readjustment of its operating tension, careful, periodic cleaning, possibly lubrication with a minutely thin film of vaseline, or other precautions and doctoring, depending on the type of the device. Some volume controls, however, are so constructed they cannot be opened for maintenance. Spares for this type should be ordered long before the control shows any sign of giving trouble. And since there is no telling whether a replacement will be available the next time one is needed, it may be as well to try to get a replacement which is so designed physically that it can be opened for maintenance.

Tube sockets of earlier types were subject to deterioration; although modern types are pretty well immune to trouble. Those earlier types (still in use in many theatres) in which connection was made by a contact pressing upward against the bottom of the tube prong went wrong occasionally as the socket contact lost some of its spring tension. In more modern sockets, spring contacts grip the sides of the tube prongs and such sockets give little trouble. The early types are troublesome principally with very large tubes or with very small ones.

In the larger tubes, the substantial current flowing sometimes arcs over when the contact is not too firm, or when the tube is momentarily lifted from its socket for testing purposes, or when dirt gets into the socket. The arcing roughens the contacts, producing a still poorer connection, and therefore still more arcing. In smaller tubes, loss of spring tension sometimes results in a completely open circuit, particularly at a grid contact. The amplifier then operates erratically, or not at all, or goes into oscillation and squeals, according to the tube and circuit involved. Sockets of these earlier types must be often and thoroughly cleaned, frequently inspected; and should be replaced, or at least their prongs should be replaced, at the first signs of any difficulty that a thorough cleaning does not remedy completely.

(Continued next month)

Three Dimensional Television Invented in England

Three dimensional television projection, utilizing a principle that may ultimately prove out in motion picture projection also, has been experimentally produced in England by John Logie Baird, according to Ideal Kinema, London projection magazine.

The principle employed is that of gratings (see Fig. 4, page 17, I.P. for March, 1942). Ideal Kinema says:

Alternate vertical lines of the picture represent the images for the right and left eyes; in front of the screen is a grating, which must be so computed that the right eye will see only those lines comprising the right-hand picture, and the left eye only those lines forming the left-hand picture.

Such a system is perfectly feasible for operation under the conditions apparently laid down by Mr. Baird: that the viewer shall remain stationary in one position, at a fixed distance from the screen. It is when one tries to cater for a large number of viewers, sitting in random positions, that the fun starts.

The system should be rather easier to operate with television than with film; all that is necessary is to use vertical instead of horizontal scanning, with interlacing, alternate traversals being made from images formed by the right- and left-hand camera lenses. However, if Mr. Baird succeeds in perfecting his system so that a large number of people can view the picture simultaneously, then he will have succeeded where innumerable inventors have failed. Furthermore, he will probably have discovered a principle which can be easily adapted to kinematography, and so bring the dream of the stereoscopic kinema into being.

Metal Enough for 22 Tanks Salvaged by RCA

763 tons of metal, including steel enough to build 22 thirty-ton tanks, or a mine-sweeper for the Navy, have been salvaged at the Camden, N. J., plant of RCA Manufacturing Company during the first three months of 1942.

Steel, aluminum, brass, bronze, copper, lead, nickel, tin and zinc were among the metals salvaged.

Machinery and tools formerly used in commercial production, but not helpful in war work, have been thrown into the scrap pile. 191 tons of steel was recovered from the machinery, 12 tons from the tools.

Arnold L. Pipper, chairman of the RCA committee in charge of salvage, said: "We are scrapping tools used in previous years which normally would be kept for many years, on the basis that if we don't win the war we won't need the tools."

Cost of Living Up 15 Percent Labor Department Says

Cost of living is up 15 percent, as compared with the 1935-1939 level, according to the Bureau of Labor Statistics, which surveyed prices in 21 cities. The increase is spotty, however, with living costs up 20 percent in both Savannah, Ga., and Seattle, Wash., but only 12 percent in Boston and New York. The Bureau credits price ceilings with holding down the cost of some items of an average budget, including house furnishings.

Research Council Tries Out 18-Frame Speed

A committee representing the Academy Research Council is still at work on the problem of photographing film at the rate of 18 frames per second instead of 24 as at present.

N. Y. DEPARTMENT STORES SET UP TELEVISION STUDIOS

Metropolitan Television, Inc., a licensed organization owned jointly by two large New York department stores, has leased studios and office space in a midtown skyscraper.

CONVENTION HIGHLIGHTS

(*Continued from page* 16)

most went to pieces. Eddie is wondering when he will be wearing that uniform in khaki for Uncle Sam. Ed wants to be stationed in New York City, so he can come to the writer and say, "Well, here I am in the Army, support me and feed me."

● Bumps Coogler also of Houston No. 279, and Eddie's poo-bah. Named the "Babel Commission" of the convention. All newly elected delegates had to pass an examination as to the number of union labels on their person. Hello, Jimmy Ambrosio of N. Y. No. 306. The writer witnessed that examination, which had an assistant named C. K. Peters, Jr. Poor Bumps had to work on the election board, and was all burnt up when the rest of the boys were enjoying themselves in the Elks Club right next door.

● Judge Lucian Andler, here as a guest of Eddie Miller. Andler is a charter member of the Houston Local No. 279, and elevated himself to be a Judge in that city. A friend of the writer's for many years and a swell fellow well met. He spent most of his time in the Ohio Law Library looking up more laws I guess (glued to Keys Hardt and Horace Johns).

● Joe Campbell, ex Vee Pee of the I.A., represented the Oklahoma City Stage Hands No. 112. Joe can still make the grade, despite his weight. Mrs. Campbell was at his side as usual. Both very fine people and good sports. Joe knows much about the I.A. We worked with him on many assignments for many years. Sorry again about John, Joe.

● John Dennis of San Antonio Local No. 407. A very good FLOOR SLEEPER. Big shot of the San Antone Local taking the convention very seriously, which was not relished by his wife, Gladys, who was kept busy running from 1037 to 1041 and 1047 at the Deshler-Wallick. Gladys a very sweet and demure person, but very nervous. She comes from the O'Higgins clan, the very famous horse men in the South. Got your note pinned to my door, folks.

● Manuel Ayala, Laredo Local 678, here with the San Antone boys. He is the pride of the Mexicans in Texas, is very quiet and unassuming and knows his business. And always a gentleman. Probably in line for "ambassador of good will" between the Mexican Combine (Theatrical Unions) and the American Federation of Labor. Good luck Manuel, hope you get it, and I'll keep my promise to you.

● Ernie Clark of Seattle Local No. 15. No convention would be complete without Ernie. This time he obligated the elected officials in masterly form, short and sweet. It is a bit hard to take Ernie without Charlie Crickmore. Incidentally, Crickmore and the writer are the only two living former Assistant Presidents of the I.A. The writer saw Ernie and his wife looking up at the spire of St. Patrick's Cathedral in New York City on June 9th, 1942. Ernie took the short way home from Columbus by getting off the Spirit of St. Louis in Newark, New Jersey, then finding his way to New York City. Good luck to you Ernie, you have been an inspiration to many union men. When you were opposition, you fought cleanly.

● Fred Newcomb, Providence Local 23, perennial secretary of the resolutions committee. Fred did his work splendidly. Can remember many conventions when Fred had no "mike" to assist him. He certainly took good care that his New England delegation got home "on time" from the convention city. I'm holding you to your pledge, Fred.

● Mike Mungovan of Rochester Local No. 25, a staunch, sincere friend, suggested to the writer, together with Jack Casey of New York Local No. 1, that this magazine incorporate a Stage Hands page, which would increase the circulation. It is being considered and when a decision is reached, you will be advised. Thanks for the suggestion, boys.

● E. Biencourt of San Antonio Local No. 76, is known to all as "Frenchy" because of his ancestors. Frenchy was sitting by himself during the convention in a cool spot when noticed by the writer, and was immediately joined in a confab by several of the other Texans. Frenchy is a very good pal to have.

● W. H. Clendening of Atlantic City Local No. 77 and President of the projectionists of the same Local, knows his parliamentary laws, as was shown when he took the floor several times on various points of order. He's known to us by name of Lou. Getting fatter by the hour. Told the writer he misses his old friend McCarroll of Camden, New Jersey, also a swell fellow.

● Distinguished by their dignity and aplomb were the delegation of Chicago

Projectionists Local No. 110. That local may well be proud of its representatives, consisting of Pete Shayne, Glen Sweeney, John Smith, John Mulvaney and Bobbie Burns. In former conventions, Locals 110 and 306 always sat side by side, for they were the two biggest projectionist locals in the country.

● Tom Murtha of Brooklyn Local No. 4. When Dick Walsh was a delegate to conventions, his side partner was Tom Murtha. They were seen together at all times. Now Tom is head of several labor bodies and business agent of Local No. 4, succeeding Dick. Tom really went to town in his nomination speech for Dick. These two could never be separated; their friendship is sacred.

● Bill Harrer of Philadelphia Local No. 8 is business agent of that local and former Vee Pee of the I.A. under Canavan. Bill outdid his former orations when he nominated his sister local's favorite son, Lou Krouse, for Secretary-Treasurer. Some of the men thought all the ovation was for Bill, but honestly, much of it was for Krouse.

● Many years ago, the writer gave a kid a job in the Buffalo Theatre as electrician because he had confidence in his ability. Danny Gill was that kid, and lo and behold, Danny turned up at this convention as delegate representing Local No. 10. Good luck Danny, another protege who has not failed me.

● Marvin Storler of Memphis Local No. 144 got a great kick by telling many delegates he did not know the writer, thereby having about 20 introductions to us. We met this Storler fellow way back in the old days when hair on our heads was black, not thin and gray.

● There were many old time delegates missing at the 36th convention, and though the writer was thrilled at seeing friends he had not seen in the past 10 years, as the Louisville convention of 1934 was his last attendance as a delegate, it brought back to memory the following men who were conspicuous by their absence: William F. Canavan, Fred J. Dempsey, Charles C. Shay, Germain Quinn, Oscar Scheck, Mike Carney, Frank Lemaster, Charlie Crickmore, Lew Burke, John J. Fanning, Hal Johnstone, Jim McGrath, John Skinner, Jake Ullrich, John Suarez, John Barry, Pasty Johnson, Les Dolliver, Gene Cashman, Jim Lemke, Harold Williams, Joe Magnolia, Harry Dignam, Bob Goldblatt, Harry Mackler, Sam Kaplan, Bill Dillon, Jimmy Walsh, Marty Higgins, Ed. Tinney, Lew Bullman, Cliff Clower, Dick Green, Pat Ryan, Bill Lang, Gus Durkin, Ralph Behling, Ben Harrison, Frank Munrow, Tom Trundle, Ben Connolly, Tommy Flahive, Pete Nelson, Harry Bushey, Harry Spencer, Ben Hannaberg, Guy Culver, Ben Brown, John Gatelee, John Benner, Max Ruben, Bill Madigan, Lester Isaac, Clem Rizzo, Ben Edgar, John Kelly, Bill McKinnon, Bill Kitzman, Red Rupard, Dave Berk, Barney Ryan, Dick Martin, Harry Brophy, Simon Terr, Dick Weis, and many more. These and some that I have not mentioned made it possible for the I.A. to be in existence today. The writer is speaking only of those he knew and not those that formed the Alliance. Look up your old proceedings and see how prominent many of the above mentioned names were in their time. Some were International President while others never held an office, but they were all good union men to whom the Alliance always came first. Wherever they are, may they be well, and those who have passed on, may they have peace.

L. U. 364 Pays Reward for First Bombing of Tokyo

The Akron, Ohio projectionist local has paid the reward it offered last January to the first U. S. flier to bomb Tokyo. A check for $250 has been forwarded to Brig. Gen. Jimmy Doolittle, to use as he sees fit for the men who accompanied him on the Tokyo bombing flight, or their families.

New Pictures Put on 16 MM Film for the Red Cross

Current Hollywood releases will be reproduced on 16 mm sound film for the first time in the history of the industry. The step is being taken on behalf of the Red Cross, to assist in entertaining service men in 129 hospitals in this country and overseas. The Red Cross uses 16 mm portable equipment powered by its own generators and needing no outside source of electric power.

"We are making it possible for American convalescent troops to have free entertainment no matter where they are serving," Red Cross Chairman Norman H. Davis explains. "The wounded soldier will see the same movies his family are viewing at their favorite theatre back home. In fact, in many cases he may see the productions before they are shown in the United States."

UNDERWRITERS CODE

(*Continued from page* 18)

the connections are so made that the unidentified conductor is the return conductor from the switch to the outlet.

This exception makes it unnecessary to paint the terminal of the identified conductor at the switch outlet.

2007. *Unidentified Circuits.* Two-wire branch circuits and multi-wire A.C. circuits may be tapped from the ungrounded conductors of circuits having identified grounded neutrals. Switching devices in such circuits shall have a pole in each ungrounded conductor, except as provided for motor controllers in section 4384. Polyphase circuits need not have one conductor grounded and identified, except as required by section 2514, but if one conductor is grounded it shall be identified.

2008. *Identification of Terminals.* All devices provided with terminals for the attachment of conductors and intended for connection to more than one side of the circuit, shall, unless specifically excepted, have a pair of connecting terminals properly marked for identification, unless the electrical connection between the pair of terminals intended to be connected to the grounded conductor is clearly evident.

a. Panelboards and Devices. The terminals of lighting panelboards and of devices having a normal current rating of over 30 amperes need not be marked for identification, except as required in paragraphs e and f of this section for polarized receptacles for attachment plugs and polarized attachment-plug caps.

b. Utilization Appliances. The terminals of utilization appliances need not be marked to indicate the proper connection to the grounded conductor. If the terminals of utilization appliances, of which single-pole switches form an integral part, are marked for identification, the terminal connected to the switch shall be the unidentified terminal.

c. Portable Appliances. The terminals of portable appliances need not be marked for identification.

d. Single-pole Devices. Devices, to the terminals of which only one side of the line is connected, need not have terminals marked for identification.

e. Two-wire Receptacles and Caps. Two-wire attachment-plug receptacles without screw shells, and two-wire attachment plug caps, unless of the polarity type, need not have their terminals marked for identification. Two-wire polarized receptacles for attachment plugs and polarized attachment-plug caps shall have the terminal intended for connection to the grounded conductor marked for identification.

(*To be continued*)

POSITIVE CARBON CONSUMPTION

(*Continued from page* 13)

the calculations, absolute agreement with experiment is not expected to be close, and therefore we cannot hope to get an accurate value for the vapor pressure of carbon at the temperature of the crater surface from these data. However, the trend of the data indicates the correctness of our viewpoint that the loss of evaporated carbon is determined by a process of ordinary gaseous diffusion through a non-turbulent gas. Furthermore, the absolute agreement is such that it is probable that the vapor pressure of carbon at the temperature of the crater surface lies between four-tenths of an atmosphere and one atmosphere.

If we assume that, at the maximum crater temperature, the vapor pressure of carbon is one atmosphere, then a simple theory of overloading of such an arc can be outlined. So long as the vapor pressure of carbon at the surface is equal to or less than atmospheric pressure, then a smooth streamline flow of gas around the positive carbon will be obtained and the carbon vapor will leave the crater surface by diffusion through this gas.

However, if the current is raised to such a point that this sublimation temperature of carbon is exceeded at points on the crater, the excess pressure of carbon vapor developed will produce spurts of gas away from the crater face and cause a turbulence. The turbulent flow will allow fresh air with a low concentration of carbon vapor to come close to the crater face and this will result in such a high concentrational gradient that the diffusion and evaporation of carbon from this part of the crater face will be extremely rapid. The rapid evaporation will, of course, cool the spot on the crater very rapidly, restoring that part of the crater to normal operation. At overload currents this process goes on repeatedly, resulting in an unstable arc and in a sputtering or hissing noise. Just below this current, however, smooth operation is obtained, corresponding to streamlined flow and steady diffusion of carbon vapor.

Patents Glass Fiber Protection for Film Perforations

To protect film perforations against wear and tear is the object of an invention patented by Leon Guyard of Paris, France, and assigned to the Owens-Corning Fiberglas Corporation. The U. S. patent number is 2,283,202.

A narrow, continuous ribbon of glass fibers is embedded in the film along the perforations, according to the patent description, so that each perforation is surrounded near the edge by flexible glass fiber reinforcement.

Theatre Repair Essentials Will Get Priorities

Theatres will be able to obtain essential parts and materials for emergency needs in spite of priority restrictions by applying to the local office of the War Production Board, the Board announced on June 13th.

The procedure will be somewhat cumbersome, but it applies not only to actual breakdown but, according to the Board's statement, to cases of "threatened or imminent suspension of operations because of damage, wear and tear, destruction, failure of parts or a similar situation."

Theatres are directed to submit requests for emergency materials authorization, not to Washington, but to the nearest WPB field office. Requests may be made by letter, telephone or telegraph. Faster service will be obtained in this way than by communicating with Washington directly, the Board asserts.

The field office, however, has no direct authority, according to the statement, but must itself communicate with "the proper authorities" in the national capital, and Washington—if it approves—will wire a preference rating for the needed equipment or apparatus directly to the theatre.

Christopher J. Dunphy, Chief of the Amusements Section of WPB, and Frank A. Duggan, Chief of the Office Buildings, Hotels and Restaurants Section of WPB's Service Branch, are jointly in charge of these procedures.

Sarnoff Looks to Post-War Growth of Television

In his report to RCA stockholders, David Sarnoff commented on the post-war possibilities of television and pointed out that the medium is establishing a reputation in civilian defense. More than 85 police precinct stations in New York are equipped with television receivers for reception of educational programs, directed at air-raid wardens and the public, he said.

Radio Corporation of America net profit for the first quarter, after tentative provision for taxes, was $2,030,988, Sarnoff reported. Profit was $108,814, or six per cent more than the same 1941 period when $1,922,174 was reported. Consolidated gross was $44,541,395, an increase of 37 per cent over the $32,576,073 reported last year.

Veteran Projectionist Honored at Fox Dinner

Leon Di Titta, of N. Y. Local 306, who has had more than 26 years service with 20th-Century Fox, was among guests at the speakers' table at a dinner held recently by the company to honor employes of over 25 years' standing.

PRINTED IN U. S. A.

Simplex for Better Projection and Conservation—Always

PROJECTION

THE MOTION PICTURE PROJECTOR is no longer a mere mechanical contrivance, cranked by hand, or made to operate by the simple closing of a switch. The Projectionist of Today must have an excellent knowledge of mechanics, electricity and optics and is in charge of a delicate and complicated mechanism made with scientific accuracy to handle a fragile and inflammable material.

THE PROJECTIONIST has a great responsibility—for a failure to measure up to the right standards means that all the producer, director, actor and cinematographer have striven for loses much of its artistic and commercial value, — the pleasure of the audience is lessened,—the exhibitor is subject to constant and unnecessary expense, —and lives and property are endangered.

Better Projection Pays

Screen Presentation is an Important Part of Good Showmanship

Simplex

"PROJECTION"

An advertisement first published in 1922 by this company has for twenty years received the full approval of Exhibitors, Managers and Projectionists. ★ It is reprinted at this time in the hope that it will be a continuing influence for the encouragement of BETTER PROJECTION and to cooperate in the campaign for NATIONAL CONSERVATION

Reprinted by request in co-operation with the conservation program

NATIONAL THEATRE SUPPLY COMPANY

COMPLETE SOUND AND VISUAL PROJECTION EQUIPMENT

Simplex

INTERNATIONAL PROJECTOR CORPORATION

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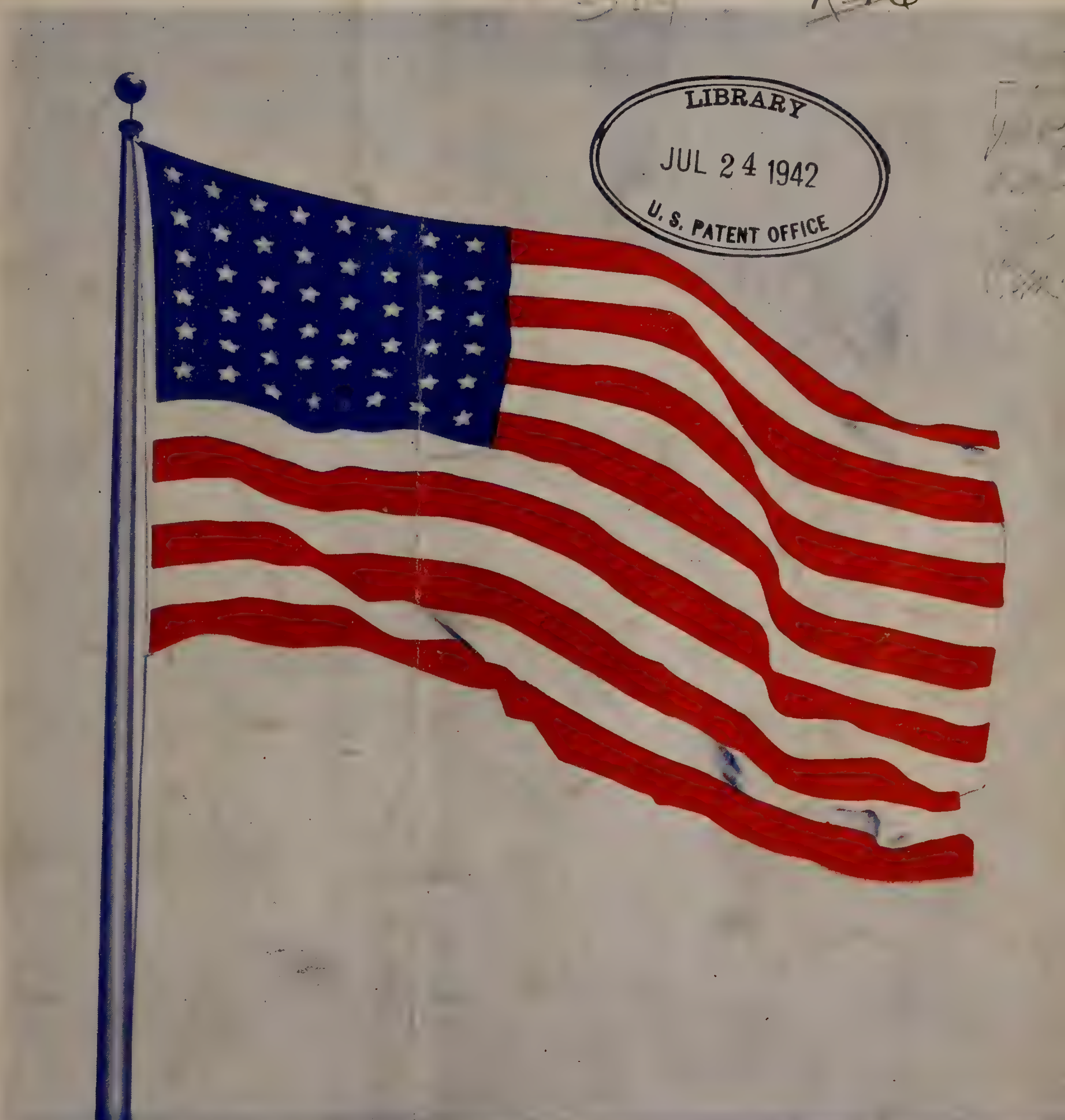

JULY 1942
VOLUME 17 • NUMBER 7
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PRINTED IN U. S. A.

America's Secret Weapon

You won't find it on the production lines at Rock Island or Willow Run.

It isn't guarded at the Brooklyn Navy Yard, or tested at Aberdeen.

But it's the toughest weapon these men you are looking at will ever take into battle. It's the stuff with which all our wars are won.

The boy in the uniform doesn't call it *morale*. That's a cold potatoes word for something John American feels deep and warm inside.

Perhaps he can't give it a name. But he can tell you what it's made of.

It's made of the thrill he gets when his troop train stops at a junction point and fifty good-looking girls are at the station with cigarettes.

It's made of the appreciation he feels for a bright new USO clubhouse where he and his friends can go for a few hours' rest and relaxation.

It's made of laughter and music—when Bob Hope or Lana Turner visits his camp with a USO show.

It's even made of a cup of coffee and a Yankee smile—at some lone outpost in Alaska or the Caribbean

Maybe it's just a feeling of kinship with this land of a hundred million generous people. Maybe it's just the understanding that this whole country cares; that the soldier is bone of our bone; that he and we are one.

Name it if you can. But it's the secret weapon of a democratic army.

What can you do to sharpen this weapon? Give to the USO. This great national service organization has been entrusted by your government with responsibility for the service man's leisure needs.

The requirements of the USO have grown as enormously as our armed forces themselves. This Spring we must have $32,000,000.

Give all you can—whether it's a lot or a little. Send your contribution to your local chairman or to USO, Empire State Building, New York City.

★ USO ★

A N N O U N C I N G

The New Victory Carbons

Designed to Conserve Copper for War Needs

Winning this war is the first objective of every American. The will for Victory includes taking in stride whatever sacrifice or inconvenience may be occasioned by the demands of our war effort.

Government curtailment of copper necessitates reducing the thickness of copper coating on "National" copper coated high intensity projector carbons. This may result in a slightly longer spindle on the carbons, and in the case of the 7 mm — 6 mm combination, may result in some reduction in screen illumination, although there will still be sufficient light for satisfactory projection.

Fortunately, the culmination of research work on the 8 mm — 7 mm trim makes it possible to burn these new carbons, even with the thinner copper plating, and to obtain even more light with the same current formerly used (within limits of the new maximum). Savings as high as 30% in carbon consumption can be had for the same amount of light on the screen if the present light level is satisfactory. When using power sources designed for "Suprex" type lamps similar savings can be made, while retaining the same screen illumination as formerly, by shifting from 7 mm — 6 mm trims to the new 8 mm — 7 mm. To accomplish this may require enlarging present carbon holders, which can be done with little effort.

Operation at reduced arc current may also, in some instances, necessitate readjustment of the feed ratio of the projection lamps in order to maintain correct position of the carbons with a minimum of manual adjustment.

The trade-mark on these new Victory carbons is imprinted in *white*, instead of the familiar *blue*. Maximum allowable arc current is also stamped on each carbon. It is important that this current limitation be observed.

The words "National," "Suprex" and "Orotip" are trade-marks of National Carbon Company, Inc.

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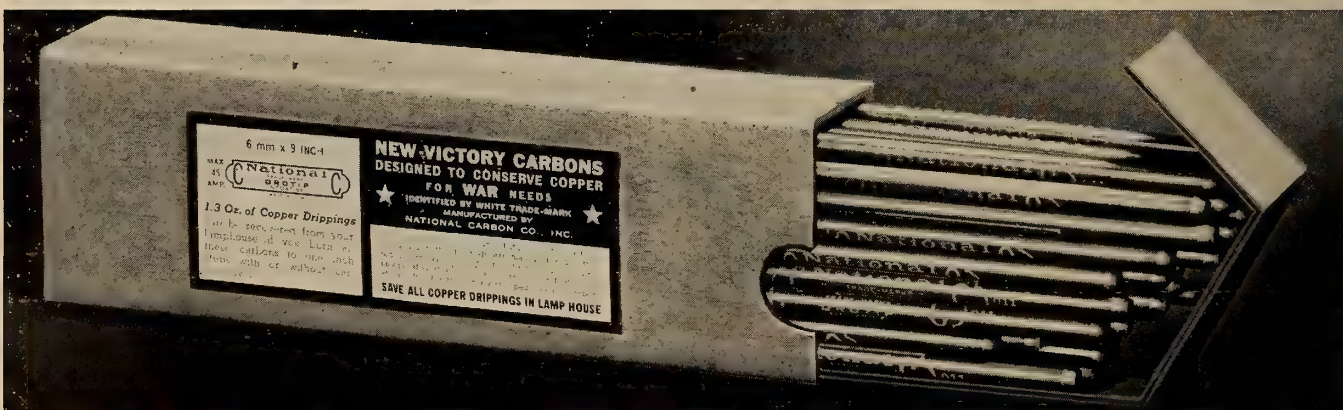

Save the Copper

Most of the copper used for plating copper coated projector carbons drops to the floor of the lamp house when the carbons are burned. Continue to save these copper drippings and turn them over to an authorized scrap dealer or to such other agency as may be designated by our government.

RECOMMENDED TRIM AND RANGE OF ARC CURRENT FOR LAMPS USING COPPER COATED, HIGH INTENSITY, PROJECTOR CARBONS

Type of Arc	*Arc Current — Amperes*	*New Victory Carbons — Size and Type*
"1 Kw" High Intensity, A.C.	52-66	7 mm x 9 inch H.I., A.C. Carbons in both holders
"1 Kw" High Intensity, D.C.	40-42	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *adjustable* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *fixed* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C.	56-65	8 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative

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International PROJECTIONIST

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Edited by Aaron Nadell

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Monthly Chat

LOCAL UNION 364 of Akron, O., has received a $250 check—its own check—from Secretary of War Stimson. It was an award the local pledged right after Pearl Harbor to the first American airman to bomb Tokio, and paid in due time to General Jimmie Doolittle. The War Department head sent it back, with a statement that such gifts are against the law. But there's no law against conserving materials; quite the contrary. And who knows, perhaps a handful of your copper drippings, and a few scraps of some of the other metals you've conserved, will be in the next bomb that drops on Hirohito's imperial palace.

• • •

Among the materials that might be more carefullly conserved is motion picture film. For film is a nitrogen compound, and all the fixed nitrogen the government can get is needed for making nitrotoluol and other high explosives. Yet the mutilation of prints by addition of personal changeover cues goes merrily on and on.

We sat in the other day on a "bull session" on the subject of film mutilation. One projection supervisor, his assistant, half a dozen working projectionists and IP's own Harry Sherman exchanged views on why projectionists add changeover marks of their own. More careful attention to threading up in accordance with the pick-up speed of man's own motors was recommended as the correct procedure. But the producers did not escape caustic comment. They still put black changeover marks on dark backgrounds, instead of using white circles against such backgrounds; and they still cut the film to bring the changeover into scenes of fast action. Yet the craft certainly doesn't help matters by mutilating the print with everything from soap to the girl friend's lipstick.

• • •

The five hundred and fifty-odd members of L. U. No. 110, Chicago, have bought $30,000 worth of war bonds, and the local officials are still dissatisfied with that showing. They are urging the membership to buy still more—to buy to and past the point where it hurts.

• • •

Time is soon coming for working projectionists to sharpen their pencils and their wits. IP will shortly announce a new contest, open to all actual projectionists, suited to the times, and with prizes you will be very happy to win.

A. N.

INTERNATIONAL PROJECTIONIST

VOLUME XVII JULY 1942 NUMBER 7

Some New Routine Precautions in the Maintenance of Amplifiers

II

By LEROY CHADBOURNE

IN ADDITION to watching his amplifier and all its component parts far more carefully than he did under peacetime conditions, the projectionist will or should pay far greater attention than ever to the workmanship with which he makes either minor or important adjustments and repairs. Faulty procedure, which in the past may have done no greater harm than to damage some part that could easily be replaced, today and tomorrow may damage a part that can't be replaced, or at least not for a long time. Repairs of a nature to give rise to possible future trouble may once have been tolerated — even encouraged on occasion to save prolonged delay or excessive overtime; but the situation is different now; the future trouble may prove irreparable when it arrives.

Again, the projectionist should develop habits of greater watchfulness in dealing with power amplifiers large enough to give him a dangerous electric shock. He is likely to have to get into the insides of such amplifiers much more often than in the past. And of course, the more often one deals with high voltage, the better the chance of being seriously shocked sometime or other, unless really careful habits are set up and followed. A shock from a theatre amplifier is not likely to prove fatal—although men have been killed repairing even small home radios—but it is very likely to "throw" a man hard enough so that he will injure himself by striking against some object in the projection room. And there's not the least excuse for any such accident—the precautions are simple and fool-proof.

With respect to repairing parts safely, be particularly careful of the soldering iron. It can cause accidental damage in two ways: first, by coming into unintended contact with some other part while it is being used for repairs; secondly, through prolonged heating of some lug or bolt to which it is intended to solder a wire. Occasionally the lug or bolt will be in physical contact with a mass of metal large enough to carry the heat away almost as fast as it is applied. The natural tendency is to hold the soldering iron on the lug longer, with the idea that eventually it must heat up. Usually it will. But in the meanwhile all the surrounding parts have become thoroughly heated, perhaps thoroughly enough to be injured. Nearby soldered connections may be weakened. Further, certain types of coils used in some amplifiers may actually be burned out by prolonged application of the soldering iron to the contact posts of those coils. Since the heat is being carried away almost as fast as it is applied, the lug won't reach soldering temperature until parts of the coil do, and at that temperature a thin wire may melt and open circuit.

One remedy is to use a larger iron, which will apply so large an amount of heat so quickly that the lug will reach soldering temperature before the interior of the coil can become seriously overheated. Another remedy is to produce the same effect by substituting an alcohol torch for the soldering iron—a third, and the best where it is possible at all, is to disconnect the lug from the coil while soldering the wire to it.

Simple carelessness in handling tools, particularly in tight places, sometimes produces another form of damage in the process of making repairs. On many exposed coils of thin wire, the thin layer of insulation is all that keeps the coil from short-circuiting. A screwdriver or pair of pliers that slips in such a way as to bruise the coil may short-circuit it, or may open-circuit it by breaking one of the wires. It may do neither, but only scrape away enough of the insulation to expose the wire, in which case, if it is thin wire, it may very possibly corrode through in the course of a few months; that possibility is increased if the theatre is located in an industrial

neighborhood where there may be chemical fumes in the air.

Another point to watch for is long-term corrosion resulting from use of the wrong flux. Use rosin flux—most conveniently applied in the form of rosin-core solder. A stronger flux does a quicker and surer job of soldering, and does not require quite so much attention to cleaning the wires in advance. Further, the stronger fluxes are perfectly satisfactory for some types of wiring; they can be used with substantial safety on heavy power wiring, for instance. But they can't be used safely on the thin wiring of amplifier interiors, because the small amount of uncombined flux that may remain after the job is done may be enough to eat through a thin wire. More important, in some sound circuits the connection does not have to be opened by corrosion to destroy its usefulness. It needs only to be weakened, in such circuits, to create seriously noisy sound.

Also undesirable under war conditions is the kind of repair work that does not run down and correct the *cause* of a trouble, but merely replaces a burnt-out resistor or other part and lets the job go at that. Meaning that the cause of the burn-out may remain to produce a new burn-out in the future, when perhaps another replacement part won't be available. The cause should be uncovered wherever possible. High line voltage, or voltage surges, operation at excessive volume, lack of adequate ventilation, momentary weakening of some related part, incorrect wiring or fusing —all should be looked into.

Trouble Causes

There is always a natural (and lazy) tendency to assume that the particular part that broke down happened to be inherently faulty. The odds are invariably against that assumption. The part in question—whichever part it is —was specified by the manufacturer of the equipment not only as suitable but as providing a reasonable safety factor. It was inspected and tested according to some standardized procedure planned to show up hidden weaknesses. Of course a faulty part can get past inspection now and then, once in a hundred times or in a thousand times or in ten thousand times. Then the odds are one to a hundred, or one to a thousand or one to ten thousand that the cause of the trouble was not a fault in the part, but some definite condition in the projection room which should be run down. In this connection remember that the vast majority of amplifier parts are not subjected to mechanical wear, and therefore cannot *wear* out. When one fails, there is likely to be a discoverable reason. Look for it.

The commonest reason is overheating, since this condition is likely to bake the insulation, which is also the dielectric material, out of condensers; similarly, overheating changes the composition, and therefore the resistance value, of certain types of composition resistors; it reduces the tensile strength of some materials, including copper; weakens the value of waxed cotton insulation; tends to destroy rubber insulation, and alters the values of some types of electrolytic condensers by promoting evaporation of moisture. Excessive applied voltage, operation at excessive volume and lack of sufficient ventilation are three prime causes of overheating.

Many modern amplifiers are equipped with a switch, transformer tap, or other arrangement to compensate for incorrect line voltage. Commonly, in the past, these adjustments were set at the time of installation, and seldom or never checked from then on. Under today's conditions, the line voltage should be checked at reasonable intervals — say, once a month or so. This may be done in cooperation with the power company, if desired. The check should be complete—repeated at different hours of the day and not always on the same day of the week. The fact that your community had predominantly high or low line voltage at the time your amplifier was installed does not mean the same condition will continue throughout the war. The amplifier line voltage compensator should be reset freely whenever these tests show that a change is called for.

Similarly, ventilation conditions may change, both with the seasons and with any alterations in the positions of large apparatus in the projection room. Putting in a new film cabinet, for example, has been known to damage an amplifier by blocking the air currents which formerly helped keep it cool in operation. In all periodic inspections of equipment, note as extremely important any rise of operating temperature above that formerly encountered. Install a small fan if conditions seem to call for it.

Volume should at all times be kept down to a safe level, to avoid overloading tubes and parts associated with them. In a Class A amplifier any clearly visible fluctuation of the needle of the plate current meter at high volume is an indication that the volume is too high for complete safety.

Maintenance Supplies

Rosin-core solder, tape, and all similar supplies needed for maintenance and repair work should be stocked now as generously as possible, while supply dealers and even hardware stores still have such things on their shelves, and are permitted to sell them. At present, theatres can obtain priority on such items if urgently needed, but the process is slow and cumbersome, and it is possible that in the future the government may withdraw the privilege entirely. Similar considerations apply to repair tools, soldering irons, test meters and so on. Since in the future they may not be available to the theatre, even under priority, and since the theatre is clearly going to have more urgent need of such items than ever in the past, buy them now.

Other maintenance supplies should be procured particularly with reference to types of work which now may have to be done in the projection room although formerly they were avoided by simple replacement of an entire part. Have on hand screwdrivers and socket wrenches of all sizes and types needed to open every part in the amplifier in case occasion should arise.

Lay in some empire cloth. This is linen impregnated with an insulating compound. Remember that rubber tape may not be available long. You don't want to hoard rubber, and besides it hardens in time. Empire cloth lasts forever; it is available in both sheet and tape form, and it is an extremely good insulator.

Buy a meter or so, even though second hand, if you have none. What kind of meter matters less, in these times, than the mere fact that it is a good quality, high resistance instrument. If you are not sure it is in good condition have it checked by your supply dealer or sound service inspector. Almost any d.c. meter, regardless of its scale, can be made in a pinch to read almost any d.c. voltage or amperage by using suitable resistors in combination with the instrument. If you do not have all necessary meters on hand, learn how to connect the meter or meters you do

(*Continued on page* 19)

NO COPPER DRIPPINGS, NO NEW CARBONS

No copper drippings, no new carbons—this is the order the War Production Board is expected to put into effect any day.

The Board already has issued instructions for the disposition of copper drippings saved by projectionists to date. They are to be turned over to the local supply dealer.

IP suggests that when this is done the theatre take the trouble to obtain a receipt from the supply dealer.

When and if the anticipated enforcement order goes into effect, supply dealers will not sell carbons unless a specified quantity of copper drippings is turned in. The supply dealer will not be able to help a friend in trouble, because he himself will not be able to obtain carbons unless he shows a receipt from an authorized junk dealer for a designated quantity of scrap copper sold.

New Method of Coating Lenses Results in Tough, Hard Film†

A new chemical method of reducing the reflectance of glass is described. It is compared experimentally with previously known chemical methods of reducing the reflection, and is shown to be superior in many respects. The new method produces a tough, hard film of very low reflecting power. The process requires neither vacuum nor expensive equipment and is suitable for many optical glasses.

By F. H. NICOLL
RCA MANUFACTURING COMPANY, INC.

AS LONG ago as 1900, Rayleigh[1] pointed out in one of his papers that hydrofluoric acid diluted one part in 200 of water removed a thickness of glass corresponding to about 1/4 wavelength of light per hour. At the same time the glass, if agitated, remained perfectly polished. The thickness corresponding to 1/4 wavelength is of particular interest in the production of non-reflecting films. If some compounds of low refractive index were left on the glass while the remainder of the glass was dissolved away, then a dilute solution, such as Rayleigh used, could produce a film of low reflecting power.

With a view to investigating the effect of hydrofluoric acid liquid and vapor at the same time, some samples of window glass were placed half in the solution and half out. A solution of one part concentrated hydrofluoric acid (48 per cent) to 200 parts of water (1/4 per cent HF solution) was used, the solution being contained in a 50 cc waxed beaker with a waxed glass lid. After 64 hours at room temperature, the glass in the liquid had been thinned appreciably, but was still polished in appearance. Immediately above the liquid, however, were interference colors ranging from blue near the liquid to straw color about 2 or 3 mm above the liquid. These colored films appeared to be perfectly transparent and the glass underneath did not appear to be etched or pitted by the acid vapors.

Method Standardized

This result was sufficiently encouraging to justify further investigation. Experiments were therefore continued using 1, 2 and 4 per cent HF solutions with the sample suspended horizontally over the liquid. The results were now more uniform and the films could be tested and examined more readily, since the area was much larger. It was observed that condensation of the water solution of HF on the film during its formation removed the film or made it very fragile. For this reason, it was found desirable to cool the bottom of the container to a temperature below that of the glass in order to prevent condensation. Water from the faucet at about 17 degrees Centigrade, about 10 degrees below room temperature, was found to be satisfactory.

The most satisfactory arrangement for producing uniform films seemed to consist of a shallow tray two or three inches high with the flat piece of glass to be treated placed over the top, its lower face exposed to the vapor of the acid. The tray itself was supported by blocks about 1/4 inch high. Water to a depth of about 1/2 inch was circulated around and under the tray at a temperature of about 10 degrees below that of the room. The glass was usually cleaned with powdered chalk and water, although this was not always necessary. Under these conditions, with a 1 per cent solution, about 6 to 10 hours (depending on temperature) was required to produce a film of purple color on a piece of ordinary window glass. This film reduced visible reflections to a minimum, about 6 to 10 per cent of that from untreated glass.

Fig. 1 shows a curve of reflection against time of exposure for one side of a piece of glass exposed on a tray 2 inches deep. The water bath was kept at about 15 degrees Centigrade and the average room temperature was 25 degrees Centigrade. The glass used was 1/8-inch Libbey-Owens-Ford "Double Strength" window glass, glazing quality. The acid solution was 1 per cent HF and about 50 cubic centimeters were used, covering the bottom of the tray to about 1/16 inch. Some of the products of the etching remain as a white film on the glass, but these are subsequently washed off with water. The reflection measurements for this curve were made with this white film remaining on the glass, but the approximate values of the reflection after the film was washed off are given by the broken line.

Effect of Concentration

Some investigation was made of the effect of concentration and there was evidence that about 5 per cent HF was the greatest concentration that would produce a suitable hard film without heavy etching. The more concentrated the solution, the more rapid the production of the film. For instance, the vapor from the 48 per cent HF produced a purple film in about two minutes at room temperature, but the glass was so heavily etched that it became translucent.

These films produced by hydrofluoric acid vapor were proved to be true interference films of high light transmission by comparing the transmission of glass with and without a film on it. The re-

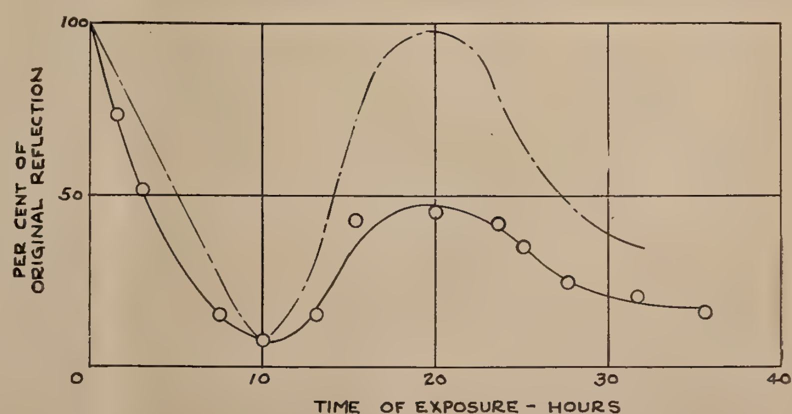

Fig. 1. Reflection as a function of time of exposure for window glass in the vapor of 1 per cent HF.

† RCA Review, Jan., 1942.

TABLE I.

Quality of Films Produced on Various Glasses

Good n	Good $(n_F—n_C)$	Fair n	Fair $(n_F—n_C)$	Poor n
1.5147		1.5232		1.5123
1.5158		1.619	.0169	1.525
1.5159	.0095	1.6214	.0172	1.7 (X-ray glass)
1.5166	.0088			1.47 (Pyrex)
1.5177				
1.5179				
1.5243	.0085			
1.6204				
1.6214	.0170			

sults were similar to those with evaporated transparent films. The transmission was considerably increased at the same time that the reflection was decreased. A pile of nine plates of window glass had a measured transmission of 51 per cent, which is quite close to the theoretical value. A similar pile of nine plates of treated window glass, with the reflection at each face reduced to between 8 and 10 per cent, gave a measured transmission of about 88 per cent which is within a few per cent of the calculated value if the absorption of the glass is taken into account. In addition to the increase in transmission, an image viewed through the treated plates had much better contrast, and was practically free of multiple images. These results show that the transparency of the films produced is very high and that very little etching takes place.

Various Glasses

A number of different types of glass were tested for their reaction to hydrofluoric acid vapor. In a number of cases non-reflecting films were produced and the results, where possible, were correlated with the composition of the glass. Libbey-Owens-Ford window glass produced very fine non-reflecting films. In particular, the "Single Strength" and "Double Strength" types were satisfactory. Plate glass was usually satisfactory, but in some cases spurious marks were brought up, although no evidence of polishing marks were seen.

Several of the glasses forming good films by the above technique were known to contain more than 10 per cent calcium oxide. On the other hand, some of those not forming a film were known to contain less than 5 per cent calcium oxide. This led to the belief that the films were calcium fluoride formed by the action of the hydrofluoric acid vapor, the other products being removed as vapors or during washing in water. This is seen to indicate a film of index slightly less than 1.3. Calcium fluoride is one of the few possible substances that could be formed from a glass and possess such a low index of refraction, unless a skeleton film is formed. This latter possibility seems to be doubtful since a drop of oil could be wiped off the film without affecting the reflection or color of the film.

A considerable number of small samples of various optical glasses were also tested. The compositions were not known, but the index of refraction n and the approximate values of the dispersion $(n_F—n_C)$ of the various samples are given in Table I. n_F and n_C are respectively the indices of refraction for the F and C lines of the solar spectrum. The glasses are tabulated in three columns according to the ease with which the hydrofluoric acid vapor produced a non-reflecting film. Those listed as good formed hard films of low reflecting power with little or no etching. Those listed as fair tended to etch visibly and in some cases the films were only faintly colored, indicating a film of too high an index of refraction. The samples listed as poor usually produced heavy etching and no interference films, while in some cases only a faintly colored brownish film could be obtained.

The compositions of the various glasses in Table I were not known, but it is highly probable that a number of the optical glasses contained at least 10 per cent calcium oxide. On the other hand, X-ray glass which formed no interference film contained no calcium oxide. These results were sufficient to show that quite a wide range of optical glasses can be treated by the HF vapor process. In particular it seems to be applicable to those glasses which do not have their reflections reduced appreciably by the old chemical methods. The process, therefore, extends very greatly the usefulness of the chemical methods.

Several properties of non-reflective film have been noted and in a number of cases they have been compared with those of an evaporated film of a satisfactory type. Some chemical solubilities have been tabulated in Table II. Solubility and insolubility are indicated by the letters S and I.

From this table it can be seen that the chemically produced non-reflecting film is very much more resistant to chemical action than the evaporated film. The solubility of the chemically produced film in dilute HF is quite a useful feature in some respects. If it is desired to remove the film from one portion of a glass sample, it is possible to do this and leave a sharp boundary merely by dipping the sample in 8 to 10 per cent HF for a few seconds. The film can also be removed in any desired pattern by swabbing with this solution.

In the case of physical properties the difference between the two types of film is also important. The chemically produced film was much harder and resisted rubbing better than the evaporated films. It could also be cleaned with water, alcohol or some commercial window cleaning solutions. However, rubbing with powdered chalk, such as is present

(Continued on page 11)

TABLE II.

Chemical Properties of HF-Produced Films and Evaporated Films

Solution	*HF - Produced Film*	*Evaporated Film*
Dilute HF	S	S
Boiling NaOH	S	S
$(NH_4)_2CO_3$ sol'n	I	S
Dil. H_2SO_4	I	S
Cold Dil. HNO_3	I	S
Cold NaOH	I	S
Conc. HCl	I	S
Cold H_2SO_4, Conc.	I	S
Boiling H_2SO_4, Conc.	I	S
Cold Chromic Acid	I	S
Boiling Chromic Acid	I	S

Expanding Field of Non-Theatrical Projection Needs Trained Union Men

NON-THEATRICAL projection using portable equipment is growing rapidly in importance throughout the country with the showing of defense films in industrial plants, clubs, churches and lodges, and to groups of air raid wardens. The current safety campaign for reduction of accidents in war factories is also being conducted in part through non-theatrical films and with non-theatrical equipment.

Promoters of such showings, who usually have both films and apparatus for rent, report that these war-time activities are reacting to create increased interest in non-theatrical motion pictures in general, with a minor run on libraries of such films in some communities, and growing scarcity of both apparatus and projectionists.

Union projectionists, however, do not figure in this increased activity as largely as they might. Primarily, the promoters say, this is because theatre projectionists aren't well grounded in the details of portable apparatus, and refuse to take much interest in it. About one union man in ten, it is alleged, takes any interest in the portable equipment he is called on to operate beyond asking how to thread it. A strong tendency to compare the equipment unfavorably with theatre apparatus is reported as typical among union projectionists.

The promoters say this attitude presents them with a serious business problem because their show, like the theatre's, must go on; yet it may be a showing of only half an hour or so. Any ineptness in the handling of the performance, any breakdown or flaw, stands out—and that group is not likely to call that particular promoter again. But when they look for men who are thoroughly skilled in handling portable apparatus they find (so they say) not more than one in ten among union projectionists.

For this reason, they assert, they often send a non-union technician to a job along with a union projectionist, and the technician, who has an intimate knowledge of all forms of portable equipment, does much or most of the work, sometimes all of it. The promoter in cases of that kind naturally tends to omit the projectionist altogether.

The other side of that story is presented by projectionists who say there just isn't enough non-theatrical work to justify taking a serious interest in non-theatrical equipment—that promoters of such showings call on the local union for manpower only when they need help, and do not offer steady employment.

A very varied range of equipment is used, running all the way from 16 mm appliances little larger than a home projector to elaborate 35 mm projection and sound portables utilizing arc lamps. These devices are constructed along the lines of the best theatre apparatus. On the other hand, many of the smaller equipments do not follow theatre ideas at all; many have no intermittent movement in the accepted meaning of that term but substitute other mechanical contrivances, including a claw action in

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COATED LENSES

(*Continued from page* 10)

in some window cleaners, gradually removed the films. Both types of film withstood heating to red heat in air. The HF-produced film on a piece of window glass was exposed to air in a furnace at 560 degrees Centigrade for about an hour. This treatment altered the reflection of this particular sample by only 10 per cent.

Cleanliness Needed

Compared with the silica film produced by the old chemical method, the HF-produced film is somewhat less hard. However, the absolute reflection from one surface of a piece of window glass treated with HF may be as little as 0.25 per cent of the incident light, whereas the silica film produced on X-ray protection glass reflects about 0.94 per cent of the incident light. The HF-treated glass is therefore a marked improvement over the other type for purposes where a low reflecting power is desired. It should be pointed out here that these nonreflective films, like any other types, tend to increase their reflection as they accumulate dust. Occasional cleaning overcomes this difficulty. Similarly, finger prints are very noticeable since the presence of the oil increases the reflection considerably. It is best to wipe these off with alcohol or some similar solvent.

The first use that suggests itself for these nonreflecting films is that of making lens surfaces nonreflecting, and of higher light transmission, as is now being done with evaporated films. Its use here, however, is limited by the fact that all optical glasses cannot be treated with hydrofluoric acid vapor to produce nonreflecting films. At the same time those which can be treated will take different times, depending on their composition. Nevertheless, its application to lenses should not be out of the question if suitable glasses are used.

This type of film can also be used to make meter fronts nonreflecting, as was demonstrated by Blodgett[2] with built-up films. These HF-produced nonreflecting films also gave a marked improvement in this case, particularly under glare conditions.

Photographs, etc., covered with nonreflecting glass had their appearance improved by the reduction of extraneous reflections. Figure 2 shows a framed picture, one-half of which has a nonreflective film on the glass front. In this case the reflection was about 10 per cent of that from the untreated glass.

Similarly, a nonreflecting film has been found to improve the contrast on a ground-glass screen used for back-projected motion pictures. A sample screen was made about six inches square. An improvement was noted when an image was observed under ordinary room illumination with the unground surface treated, and a reduction in the milkyness of the ground surface was noted when the ground side was treated.

[1] Rayleigh, "On Polish," *Scientific Papers of Lord Rayleigh*, Vol. 4, p. 546.

[2] K. B. Blodgett, "Use of Interference to Extinguish Reflection of Light from Glass," *Phys. Rev.* 55, p. 391, 1939.

Fig. 2. Photograph of framed picture with glass front, one-half of which is nonreflecting.

In The SPOTLIGHT

By HARRY SHERMAN

IN EVERY direction one reads where the government is lauding the labor end of the motion picture industry, and we look forward to the day when it will step in and refuse to permit the "powers that be" to reduce manpower in the booths by the cry of "labor shortage." It's the old cry of "wolf" or "Sam you made the pants too long." Don't get yourselves all baffled by the big wordage of these Harvard graduates. Stand by your guns and fight to retain your standards. Your working conditions can be given a big boot where "Sam" made them too long. Look ahead, for when this war is over you'll have plenty of other things to contend with, so don't add this headache. Don't fall for that old argument, but insist upon your manpower remaining as is, and should you be short of men your sister locals are there to help you out.

● Steve D'Inzillo, recently vice-president of New York Local No. 306 and a former candidate against Lou Krouse for the office of Secretary-Treasurer of the I. A. T. S. E., (Columbus Convention 1942) has joined Uncle Sam's air force. Prexy Herman Gelber appointed his life-long friend, Herman Boritz, to the vacated post, while Steve's best friend, Ben Scher (also a Columbus candidate) was given his former job at the Brooklyn Paramount Theatre.

● Looks like a very good sign when William Green of the A. F. of L. and Phil Murray of the C. I. O. broadcast on the same radio program. The subject, "A Place to Live In," concerned the housing problem for war production workers. Something in the air?

● CHERCHEZ LA FEMME! Which means "find the woman." Yes, find the woman who can keep her head during an emergency. In a recent issue of a certain trade paper there appeared a picture of a young woman threading the projector with an empty reel. This young lady, it seems, was granted the first license issued to a woman projectionist in her city (Spokane, Washington), and if the posed picture is indicative of her proficiency in the projection room, then heaven help us!

Does this young lady know that dynamite is nitrated glycerine, that TNT is nitrated toluol, and that gun cotton and motion picture film are both nitrated cellulose? That is swell stuff to put in dainty hands. We cannot help but wonder what this *projectionistress* would do if the film caught on fire, especially if a mouse ran across the projection room just at that moment.

I wouldn't care to have my children in the theatre at that particular time, and I wouldn't permit them to patronize a theatre where the management did not take every precaution to safeguard the safety of its patrons. Women, as a general rule, are emotionally unfit for work where at any moment an emergency may arise whereby the lives of hundreds and even thousands of people may be endangered.

● Tom Murtha, B. A. Brooklyn Local No. 4, is an astute politician both in the I. A. and New York State politics. Tom, you will remember, nominated Dick Walsh for the presidency at the recent Columbus Convention, and is now backing Attorney General John J. Bennett for Governor of New York. Tom is also president of the Central Trades and Labor Council, an organization representing 750,000 members of the American Federation of Labor. Before becoming a member of Local No. 4, Tom was a New York cop, marching the same beat as District Attorney William J. O'Dwyer, who opposed Mayor LaGuardia in the mayoralty elections last year. Although he is a personal friend of O'Dwyer, his first loyalty was to the American Labor Party in the support of LaGuardia. We have many members in the Alliance with the same degree of loyalty to organized labor.

Harry Sherman

● INTERNATIONAL PROJECTIONIST is published as a service to the motion picture projectionist. Its function is not only to keep him posted on all the latest technical developments in the field, but it is also to help him fight those interests opposed to the best interests of the projectionist. I. P. represents NONE but the projectionist and serves but him—to help better his working conditions and to see that he gets fair representation in the press.

● A certain exhibitor magazine cries "Everything up but admissions!" That is a laugh and it is most amusing to see the crocodile tears that are being shed about increased costs. Let some business agent appear on the scene with a request for a slight salary increase for his men, and the theatre owner will shout to high heaven about the terrible losses he has been taking. Should the business agent be successful in getting a two dollar a week increase for the projectionist, the exhibitor will use that as an excuse to tilt the price of admission upward. No matter how small the theatre may be, a nickle increase in the price of admission will add another few hundred bucks to the box-office receipts. Say, for instance, that the projection room costs have been increased another $10 per week; on a 5c boost only 200 admissions would be necessary to even things up. How many more than 200 admissions per week does the smallest motion picture theatre get? Every 5c boost above that number is gravy for the theatre owner—figure it out for yourself.

● Boys, it is up to you in your own territory to stop encroachments in the field, such as the CIO film workers (white collar) or the CIO non-theatrical projectionists. You do your part and you may rest assured the general office of the I. A. will take care of its end. Do not assume the "Let George do it" attitude. This is your jurisdiction and do not permit these phony outsiders to blitz you out of what you have fought for all these years. Your charter gives you the jurisdiction over all movies run in your territory, whether 16 or 35 millimeter, and by permitting others to take it away from you, you are laying

yourselves open to lose more ground. Fight this with everything you have!

● John Smith, B. A. of Chicago Projectionist Local No. 110 was in town recently for several days, but was much too fast for the writer. John, I missed you every time I went looking for you. Say, perhaps you could teach me that trick for many times I have wanted to duck certain people, only to be nailed on the head. What's the formula, John? I'll catch up with you one of these days.

● Hey, you Canadians, listen and watch out. Wolfe Cohen, Dominion district manager for Warner Brothers, who was recently in New York conferring with his higher-ups, stated in the trade press that the motion picture theatre attendance this summer was 25 to 35 per cent higher than that of last summer—despite the gas rationing, high industrial employment, and general war activities. When attempts are made to reduce your man-power (they have been tried), or the present emergency is used as an excuse to cut your wages, bear the aforementioned statement in mind and turn it to your own advantage. Why not keep these clips in a scrap book, or better still, save the entire issue for future reference? Some day you may find them mighty important.

● The motion picture industry has had the foreign market knocked from under its pins by the war, and there has been plenty of howling about it. However, we notice from reports in the trade press that the industry is grossing about $4,000,000 weekly from the home market, an increase of 15% over the previous years. The tops in grossers are Metro-Goldwyn-Mayer, 20th Century Fox, Paramount and Warners. MGM leads with about $1,000,000 a week, and the other companies just a bit less. Poor old Columbia has just announced a net profit, after all taxes have been provided for, of only a paltry $941,950 for a nine-months' period (this seems to be better than 300% over last year). Mr. J. Cheever Cowdin, chairman of the Universal board, announced that for the first 26 weeks of 1942 the company has more than doubled the profits of last year. We hope you projectionists can now understand why it is impossible to get an increase, and why the companies running theatres cannot afford to buy new projection equipment when needed. After all, they must economize! Watch out for the usual summer cut, but also watch the bonuses that will soon begin flying (for them).

● Don't forget your conservation duties, boys, and save wherever you can. It will help protect your jobs, for when the source of supply runs out, you will be out of luck. Constant oiling and cleaning will prolong the life of your machine, and conserving your supplies will prevent shortages. When Uncle Sam says you get no more supplies, you can look for a "closed for the duration" sign to be plastered on your theatre. This time it will pay to be stingy with carbons, etc.

● The writer wishes the members of Minneapolis Local No. 219 good luck in their struggle to obtain the increase they are after. From personal knowledge of the Independents in that territory, we know that they have all been making lots of money. Although the exhibitors' chronic cry is that they are losing money, just you try to buy one of their theatres! It is so very funny that despite the "terrific" losses they claim year after year, they are still able to send their families north in the summer and south in the winter for their vacations. They themselves lose loads of dough rolling the ivories on their convention trips, and still they cry "poor mouth." (Since writing the above, it has come to my attention that Minneapolis exhibitors report a 25 percent increase in receipts over last year.)

● President Dick Walsh left for the west coast on important I. A. business matters, one of which is a general check-up of the situation concerning all local unions in that territory. Dick plans to be gone for some time, and expects to return with a satisfactory report to the membership. According to reports in the trade papers, there seems to be some dissension there, but upon investigation the writer finds that it is just a bit of wishful thinking on the part of opposition interests.

● It seems that Bob Tomsen, B. A. of St. Louis Local No. 143, had the right dope, as per his article which appeared in the June 1942 issue of I. P. In his article Tomsen stressed the importance of assigning experienced motion picture projectionists in the armed forces to the class of work for which they are trained. The government would thereby insure its huge investment in films and projection equipment by having it handled by men who are familiar with all phases of the costly equipment. Walter Wanger, the producer, issued a statement recently, which was released by the United Press and appeared in all newspapers, in which he made the following remarks: "When the government wanted tanks, it did not move Detroit to Washington. Yet when the government wanted movies, it took some of the top experts, put them in pretty uniforms and stationed them in the capital." He also said that some officials

Mounted, uniformed police auxiliary of Cleveland Local Union 160, now ten years old. Harland Holmden, business agent, commands the troop.

were "fumbling, cockeyed and full of fear." Bob Tomsen and Walter Wanger are both in agreement, it seems, that the proper assignment of men in the motion picture industry to the tasks for which they are fitted is one that merits greater consideration from the government.

● For quite some time it has been customary for a number of local unions in the Seventh District to hold a get-together once a year for the purpose of straightening out all difficulties confronting them. The meeting, this year, will be held July 30 at the Andrew Jackson Hotel in Knoxville, Tenn. When the roll is called representatives of the "Big 6" will answer—Atlanta, Ga., Local No. 225; Birmingham, Ala., Local No. 236; Chattanooga, Tenn., Local No. 259; Knoxville, Tenn., Local No. 405; Memphis, Tenn, Local No. 144; and Nashville, Tenn., Local No. 626, all projectionist locals. Burson Lowry, Chattanooga Local 259, is president of this group, and O. L. Williams of Memphis Local 144 is the secretary. When the business of the day is finished, the boys will then gather around the festive board at the 27th anniversary dinner given that evening by the Knoxville Local No. 405. It is expected that the I. A. General Office will be well represented at the dinner by the appearance of President Walsh, Secretary-Treasurer Krouse, and Asst. President Raoul. INTERNATIONAL PROJECTIONIST extends to the officers and members of Local 405 our very best wishes for a happy event.

● We learn (through secret channels) that the new administration of Pittsburgh Local No. 171 is doing a swell job in the reorganization of the local. Many of the members of that local are old friends of ours and we plan to pay them a visit in the very near future. Good luck in your endeavors—will be seeing you soon.

● Look, all you seekers of knowledge, in addition to thinking about conservation of supplies, scraping of carbons, and the general hook-up of your machines, you might give a thought or two to what the future may have in store for the craft when the war is over. The following statement made by David Sarnoff, President of Radio Corporation of America, and appearing in the trade press, is timely:

"Aside from the thrills provided by a vital service in the war, when victory is finally achieved, we must look forward to a world at peace which will need to be reconstructed. New industries and new services will demand trained men who can meet civilian needs in the post-war period. The First World War stimulated the development of the radio telephone and new receiving methods upon which was built a new art of broadcasting. In our country alone, broadcasting has flourished into a billion-dollar industry, employing hundreds of thousands of persons. The present war is stimulating a development of television, ultra-high frequency communications and the whole field of electronics, which is bound to revolutionize the older systems and methods

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Members of Houston, Texas, Local Relax in De Luxe Recreation Room

HAVE you ever been to Houston, Texas? Well, if you ever get there, don't fail to stop off at the headquarters of the Projectionists' Union Local No. 279, which is located at 716 Louisiana Street. There you will find an oasis for your weary bones. No member of the I.A. should miss this treat while in that city.

The "Club," (as the headquarters is called) is the only headquarters visited by the writer that is air-conditioned and is designed for the comfort of its members. There you will find a bar that serves you with all the coffee you can drink. A pool table for the sharks and card tables for those who like to shuffle the decks or dominoes are also available. Reading matter of all sorts pertaining to the craft is to be found there also. Loud talking is not permitted, and the club-room is kept immaculate at all times. On a recent visit to Houston, we spent many enjoyable hours at the "Club," and left it with a feeling of pride in the untiring efforts of Local 279 in looking after the comfort and welfare of its members and visiting guests.

It was chiefly through the efforts of Eddie Miller (no relation to Eddie Miller of the Boston Braves), Business Agent of the local, that the club-room was established. In addition to acting as Secretary of the Sixth District, Eddie is also International Representative for Texas and points west. His assistant, Frank "Bumps" Coogler, who takes over while Eddie is on the road on union business, is also an important factor in the success of the "Club". Eddie is the dad of Nan Gray, the Universal picture star who is married to Jack Westrope, the famous jockey. Incidentally, Eddie has passed his physical examination and expects to be inducted into the armed forces any one of these days. He is a fine looking fellow and should make a "Honey" of a soldier. (Take a bow, Eddie).

The photograph, shown at the top of this page, gives you an idea of the physical aspects of the club-room, but the air of good-fellowship and spirit of friendliness that fills the room cannot be reproduced on paper—one has to partake of it in person. Congratulations to Local 279 members and its officers for a swell job.—H. S.

Eddie Miller

More Overtime Needed for Maintenance and Conservation Under War Conditions

By AARON NADELL

PROJECTIONISTS are going to have to arrange their personal and social affairs from now on to allow for more overtime in the theatre, and exhibitors will have to authorize additional overtime. The projection room will operate on an abnormal basis for the duration. Many steps of conservation and maintenance will have to be taken that were never necessary in ordinary times. Many new responsibilities will fall on the projectionist.

Some of the extra work of course is taken care of during show time—collecting copper drippings for example. But many other duties are such as to distract the crew from their primary work of putting on the best possible show; or would require stopping the machinery; or involve tests that cannot be carried out with an audience present. Those operations must be attended to before or after show hours.

In these abnormal times repairs must be made more thoroughly, inspections must be both more thorough and more frequent. There can be no question now of balancing the cost of overtime work against the cost of buying a new item, and deciding in favor of the new item. Existing equipment must be maintained in the interest of conservation. If it costs more to maintain the equipment than to replace it, it still must be maintained.

Materials must be conserved in the course of making repairs. Not the quickest way to do the job, but the one that will use the least material, is the way that will have to be followed.

All of this adds to the responsibility of the projectionists. But in addition they face the problem of maintaining quality performance with parts and supplies that will come to be more and more of the "ersatz" variety. They will have to give more attention, not less, to putting on a presentable show; and with more maintenance work to do than ever before, they will have less time during show hours to attend to it.

Breakdowns More Likely

Interruption to the show has always been the normal penalty for inadequate maintenance, but while the war lasts the probability of a breakdown following neglect will be increased, owing to increasing use of substitute materials. And breakdowns will be more serious because of probable delays in obtaining replacement parts. It is quite possible that some slight neglect will result in a theatre having to stay closed for many days.

Inspection is of course the first principle and basis of effective maintenance. Most theatres have some form of inspection routine. There are some details the projectionist looks after daily; others are checked once a week, or once a month, either by the projectionist or by a visiting service inspector. Inspection, whoever does it, always costs something; at some time in the past the theatre balanced the cost of inspections against the chances of breakdown, and decided how often really thorough inspection should be made. Today that calculation should be revised, to fit war conditions, and the frequency of inspection increased.

More Inspection Needed

Where there have not been definite arrangements for periodic, thorough inspection, they should be made now. Carelessness in this respect was always costly; from now on it will be more expensive than ever, and unpatriotic besides. Inspections should be systematized, organized. Casually "looking at" this or that piece of apparatus does not constitute inspecting it. In every item of equipment there are a number of definite points each of which is to be examined in detail for the presence or absence of definite, specific symptoms. The work is best carried out with the help of a check-list or similar form. This assures that nothing will be overlooked. It also allows the man doing the work to concentrate on the details of it, instead of devoting half his mind to making up an inspection routine as he goes along.

If check-lists are in use, covering daily, weekly, monthly and semi-annual procedures, it will be desirable to revise them for war conditions, moving some items of inspection up from the monthly to the weekly list, or from the weekly to the daily list, and so on. If such lists do not exist or are incomplete they should be drawn up or improved with the help of the manufacturer's data or advice. Where the theatre has contract arrangements for service inspections there will still be many details the projectionists themselves should check on between service visits; they may draw up their check list for such work with the cooperation and advice of the inspector. Supply dealers also can advise efficiently concerning specific items of apparatus.

Drawing up check-lists, or examining existing lists in detail, will show that some important inspection tests cannot be carried out during the performance. Even in those few theatres that have complete emergency installations, with duplicate amplifiers and three projectors, it will still be necessary to measure screen illumination, and check sound from individual loudspeaker units, when no audience is present. In most projection rooms gain runs on the sound equipment will have to be made out of show hours; and the same is likely to be true of any inspection detail that requires switching off the amplifiers, changing tubes for purposes of comparison, and the like.

But in addition, all details of inspection, including those that can easily be made in showtime, should now and then be made after hours. Then every minor sympton can be followed up, checked through, whereas when the work is done in show time the man is always under some temptation to feel: "Well, that can't be followed up without stopping the show, so let it slide." When the work is undertaken after hours there is no reason to let anything slide; the job can be done thoroughly.

Wartime Repairs

Repairs, whether made to cure a trouble or to prevent one, also must be done somewhat differently under war conditions. Very often in the past a repair job meant that a faulty part was *replaced*. From now on, in the interest of conservation, faulty parts will be *repaired* whenever possible. That will usually take longer, of course. It may mean that a given job formerly handled during the show will now have to be

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NON-THEATRICAL FILMS NEED TRAINED MEN

(*Continued from page* 11)

place of the intermittent sprocket. There is also considerably more variation in detail between different makes of the same general type of apparatus than is usually encountered in the theatre.

The promoter of these showings does not buy so many different kinds of apparatus because he wants to, of course, but out of necessity. His operating conditions vary tremendously. He may be called on to function in a standard auditorium, sometimes even one equipped with a projection room, often a meeting hall, church or similar gathering place, very possibly sound-proofed. But he may have to run his show in a factory corridor, an air raid wardens' headquarters or a salesroom. He may have a short throw or a long one, a large or a small screen; he may have to use either 16 or 35 millimeter film, sound or silent, and if silent with or without record accompaniment. If he does business in the Eastern states he may encounter d.c. power lines or any of two different frequencies of a.c. He may be able to set up a sound screen with speakers behind it; he may have to use any solid screen that happens to be installed and mount his portable speakers where he can, with dubious acoustic conditions thrown in to add to his problems. But his standard for smoothness and general quality of performance is set by the theatre, and he cannot afford to fall too far below that standard.

Some promoters—a good many of them—limit their operations to jobs suited to a limited range of apparatus—perhaps only to one set of equipment, which is all they have. These small operators often run their own show, and have comparatively little occasion to hire projection help. The firms that do hire projectionists to any important extent are not one-man establishments, but large enough to meet a variety of requirements by owning a variety of equipment. But they say they can't meet their personnel needs by hiring all their men on a weekly basis; they may have six shows to put on one evening, and none at all for the next three nights or the next week.

They are enthusiastic about their business; they say the non-theatrical motion picture is a coming thing. They point out that millions of service men are coming to take non-theatrical pictures as a matter of course, owing to the use of films for instruction by the Army and Navy. That when these service men are returned to civilian pursuits they will continue to think of non-theatrical films as a common and easily available facility. At the same time the Army and Navy and Red Cross will be releasing large numbers of men trained to non-theatrical projection, and large quantities of the equipment they used probably will be offered for sale.

The theatre projectionist, however, remains an indispensable part of non-theatrical picture business. Sometimes the subject desired by the customer is available only on standard cellulose-nitrate film, which means that in many communities the law insists on the use of a licensed projectionist. Very often the customers demand that the projectionists used be union men, regardless of the type of film shown. And in every community the union local remains a permanent reservoir for skilled help, even though the skill of its members lies primarily in theatre projection.

Readers are invited to write IP, indicating how far they are interested in the technical details of non-theatrical motion picture projection. If sufficient interest appears, IP will gladly run a series of articles describing the more important types of non-theatrical apparatus, particularly with respect to departures from theatre practices.

Review Of Projection Fundamentals

IV.—Kinds of Condensers

ELECTRICAL condensers, widely used in projection room apparatus, are essentially containers for "storing" electricity as contrasted with wires which are conductors for transmitting electricity.

When a current of one ampere flows through a wire, the amount of electricity passing in one second's time is one coulomb. These same quantity (the same number of electrons) flowing in half a second would constitute a current of two amperes. Hence in a bolt of lightning which lasts only 100,000th second, the current can be 100,000 amperes (while it lasts) although the actual quantity of electricity transmitted would be only one coulomb.

If one coulomb is to be "stored" in a condenser the amount of storage "space"—to use an inaccurate term—or electrical capacitance, will depend on the voltage which is driving the electricity into the condenser. Higher voltage will pack in more electrons. The capacitance of a condenser is rated in farads (named for the English scientist Faraday), and subject to a simple formula: $C = Q/V$, where C stands for capacitance in farads, Q represents coulombs and V is voltage. Thus if one volt will cause the condenser to store one coulomb, the capacitance of that condenser would be one farad, and the formula just given becomes $1 = 1/1$. If on the other hand two volts are needed to procure storage of one coulomb, the formula becomes $1 = 1/2$, or in other words, the condenser has a capacitance only 1/2 farad. If one volt applied across the condenser will charge the condenser with two coulombs, the formula would read $C = 2/1$, denoting a two-farad condenser.

In projection room practice there are no condensers of such orders of capacitance; the microfarad (one millionth farad) is the customary unit for rating projection room condensers. One volt will cause the storage of only one millionth of a coulomb in a 1 mf condenser—two millionths of a coulomb in a two mf condenser, and so on. Condensers of more than 50 microfarads are not often encountered in the projection room; but very much smaller ones, including devices rated in micro-micro-farads (mmf) may be used in some sound circuits.

In physical construction, the simplest condenser consists of two flat plates of conducting material separated by a layer of insulating material. Some condensers of extremely small capacitance may consist only of two strips of metal foil glued to either side of a strip of waxed paper, mica or empire cloth, the whole suitably enclosed by a wrapping of paper, or by embedding in bakelite; or possibly rolled up and sealed in a little tube of insulating material. For somewhat larger capacitances a long strip of insulating material, with metal foil glued to either side, may be rolled up

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MORE OVERTIME NEEDED

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done after hours. If it was always done after hours the time the job used to take will be no guide to the amount of time it may need today.

Again, repairs must be more thorough. Formerly, a faulty adjustment might be considered quite acceptable if it would do no harm except cause the gears to wear out a little faster, or tubes to lose their emitting power a little sooner. Tolerating such a condition might be cheaper than correcting it; but today time must be spent to conserve materials, to make every repair a perfect job.

Materials used in making repairs must themselves be conserved. It is important to avoid wasting solder; it contains a considerable percentage of tin and there may not be any more solder soon. And never run new wire for any purpose if existing wiring can be rearranged to serve. This can often be done by shifting loads—transferring some apparatus to other circuits. It is often easier and quicker, of course, to run in a new pair of wires; but it is hardly consistent to save copper drippings and waste wire.

Greater Cleanliness

Routine maintenance procedures of cleaning, lubricating and so on also need more attention than formerly. When apparatus has to last for the duration, however long that may turn out to be, it must be taken care of. Corrosion or rusting of metal surfaces, formerly disregarded, should be sandpapered away, and the cause—dirt, dampness or whatever it may be—investigated and corrected. If the surface was originally painted or enameled, and the protective coating has peeled or cracked away, a new coat should be applied.

More time should be given to keeping apparatus clean, for dirt adds to the friction and strain on moving parts; it promotes corrosion, and gives rise to several forms of electrical trouble, particularly in sound equipment. Cleaning must be more thorough than in the past; and from time to time an extreme "spring housecleaning" of all the equipment should be undertaken.

In short, the projectionist has much more to do than formerly, if projection standards are to be maintained and if materials are to be conserved. He is going to need more time in which to do it. He will have to arrange to provide that time, and the theatre will have to arrange to buy it.

NTS EMPLOYES SIGN UP 100 PERCENT FOR WAR BONDS

Employes of National Theatre Supply Company's general office in New York signed up 100 percent for purchase of War Bonds under the company's payroll plan.

MAINTENANCE OF AMPLIFIERS

(*Continued from page* 8)

have through proper resistors so as to make them perform all necessary tests. This is merely a matter of practical application of Ohm's Law.

Among supplies, buy (or make) so-called test prods, which are nothing but hollow tubes of insulating material through which a wire runs, emerging at the end in the form of a long, thin metal stud; or, alternatively, in a receptacle in which a phonograph needle can be inserted to serve as the tip of the prod. With such prods it is easily possible to contact the less accessible terminals of an amplifier without risk of accidentally short-circuiting the amplifier. The wires leading from the test prods can be connected to a meter, headphones, or any other testing device.

An additional advantage of the test prod is that it keeps the projectionist's fingers out of the amplifier, reducing the risk of his being shocked.

A number of precautions against the possibility of being shocked should be taken as matters of invariable routine. Perhaps something in the order of 600 volts is about average for the high-tension line of a common theatre amplifier, with a peak current of possibly half an ampere. That voltage and current could easily be fatal if it were connected directly across a human heart. Fortunately, human skin is a very good insulator, and provides protection. But if it is moist, as with perspiration, it is not quite so good an insulator. The back of the hand, where the skin is thin, is not as good an insulator as the hardened palm and the inside of the fingers. Therefore the risk involved in a shock from a theatre amplifier depends a good deal on how, and under what conditions, the shock is received. There is additional risk in the physical injury that may result when the victim falls, or is thrown, by the force of the shock.

A serious shock can have two different causes, working voltage and stored voltage—the latter being stored in the condensers. The working voltage is of course removed when the switch is opened. Unless the trouble-shooting in process imperatively requires working on a "live" amplifier, open not one switch, but two if there are two, and if there aren't two switches to afford double protection—one in the amplifier, one in the panel board—pull a fuse if possible. The reason is that someone may come along and close the switch while you are working on the circuit.

Stored voltage is a danger in some amplifiers only. In others there are bleeder resistors which drain the stored charge out of the high voltage condensers as soon as the amplifier is switched off. Thus in one amplifier, a projectionist can work on the high voltage condensers without precaution and without the least danger, while if he tried the same thing on a different amplifier he might suddenly find himself on the floor at the far side of the projection room. Where bleeder resistors don't exist, or where you're not sure if they do or don't, short-circuit the high voltage condensers—*all* of them—before working on the circuit at all. Use any convenient metal tool with a thoroughly insulated handle.

In certain types of trouble work it is unfortunately necessary to perform tests on the live amplifier, even blocking down the "safety switch", if there is one, in order to keep the amplifier working. In such cases work only with test prods and other well insulated tools; exhaust every other possibility of effecting repairs before working on a live power amplifier at all. Make these precautions a habit that you follow automatically.

B. & L. WINS "E" AGAIN

For the second time in as many years, Bausch & Lomb Optical Co. has received the Navy's "E" pennant for continued outstanding performance in connection with the war effort. Award was made by Lieut.-Commander John T. Tuthill, Jr., the Third Naval District's public relations chief.

IN THE SPOTLIGHT

(*Continued from page 14*)

and create new opportunities after the war."

Mr. Sarnoff knows whereof he speaks, having come up from the ranks himself. As far as projection is concerned, the machines of today are basically the same as the ones in the past. True, they have been improved from time to time in certain respects but in principle they remain the same. When this shindig is over competition will be very keen and the improvements and developments in this field will revolutionize the industry. The "old timers" who do not think it necessary to keep up with the new trends and who rely upon their union cards to get them by will find themselves very much on the side-lines taking lessons from the alert, ambitious younger men who are constantly seeking ways and means of improving themselves in their chosen profession. Remember when we all laughed at sound and then at television? In the spring of 1941 RCA gave a television demonstration of a prize fight held at Madison Square Garden in New York City. This demonstration was held in a theatre quite some distance from the Garden and was highly successful. Further developments along this line have been held up for the duration, but just wait until the war is over and these developments are commercialized! Boys, don't be caught napping.

● For reasons of state, the party mentioned in this paragraph will remain anonymous. A certain I. A. official, held in high esteem by his membership and who enjoys great popularity with the members at large, recently boasted to the writer of his pulchtritude as a youngster. A momento of those early days is a photograph of himself taken at the tender age of five, wherein he appears with his hair beautifully curled, and proudly wearing a Lord Fauntleroy suit. Repeated requests for this photo have to date been met with stony silence. Can it be that his claims were slightly exaggerated and he does not wish to be exposed?

● An example of perfect team-work has been demonstrated in the splendid cooperation between Pres. Ben Pinzel and Bus. Agent Albert (Bert) F. Ryde of Buffalo, N. Y. Local No. 233. When these men took office many of the theatres in Buffalo were non-union, and the prevailing scale was very low. Today the situation is quite different—they have not only succeeded in unionizing the projectionists in their city, but made Local 233 one of the first locals in the country to establish the six-day week, and put into effect a high wage scale. Long live Ben and Bert—their loyalty to the membership is unquestioned.

● After an extended trip through the southern district, Asst. President Fred Raoul has returned to the home office looking as fit as a fiddle. His first stop was Johnson City, Tenn., where he took up some unfinished business with the local union representatives; from there he went on to Jacksonville, Fla., where he held several conferences with Pres. Hugh Austin, Bus. Agt. Bill Sullivan, Leon Cazin, and Tom Pryor, all of Tampa Local 321. Also present at these conferences was Bus. Agt. John A. Spearing of Jacksonville Local No. 511. Evidently all matters were satisfactorily adjusted.

GEN. DOOLITTLE CAN'T KEEP AKRON UNION'S REWARD

Akron, Ohio, Local No. 364 is buying $250 worth of war bonds with the money it offered Brig. Gen. Doolittle for the bombing of Tokyo. Gen. Doolittle was unable to accept the union's check, under the law.

Shortly after Pearl Harbor, Local 364 voted to pay an award of $250 to the first American airman to drop a bomb on the Japanese capital. After Doolittle's raid a check was forwarded to the general, with a request that he use the sum as he saw fit for himself or the men who accompanied him or for their families.

Secretary of War Stimson returned the union's check with the explanation that a 1917 Act of Congress makes acceptance impossible. No government official is permitted to receive a gift for services rendered in the line of his duty.

IA ORGANIZES FRONT OF HOUSE WORKERS IN NEW JERSEY

A drive for union contracts and wage scale agreements covering all front-of-the-house employes in northern New Jersey is proceeding successfully, President Richard F. Walsh announced. Organization in Bergen County has been completed, and a settlement with employers is imminent. Organizational work in Hudson and Essex counties is expected to be completed shortly.

PROJECTION FUNDAMENTALS

(*Continued from page* 17)

like a scroll and enclosed in a tube of insulating material. Again, a number of small condensers, wired together in parallel, may be piled one on the other; the whole assemblage compressed and wrapped or embedded in suitable insulation. Further, there are electrolytic condensers, described later.

Consider first the very simplest condenser form—two conducting plates separated by an insulating layer. The capacitance of the condenser, in micro-micro-farads, is given by a formula in which the significant quantity is KS/t; with S standing for the area of the plates, t for the distance between the plates, and K for capacitive "efficiency"—more accurately, the dielectric constant, of the insulating material used.

The dielectric constant of air is taken arbitrarily as 1. If a condenser is built with air separating its plates, and if mineral oil is then poured in, the capacitance of the condenser will increase to a degree which will show that mineral oil must be taken as having a dielectric constant of 2.7 compared with air. Other substances used in condensers possess dielectric constants up to 7 or higher, as compared with air.

The formula also shows that the capacitance of a condenser will be greater if the areas of its plates are increased. One way of doing this in practice, as already indicated, is to use long strips of metal foil and insulating material, and roll them up into a tight cylinder; and another, to build a number of

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PROJECTION FUNDAMENTALS

(*Continued from page 21*)

small condensers wired in parallel and all mounted in the same wrapping or embedded in insulation to form a single unit. The individual capacitances add to give the total capacitance of the unit.

Electrolytic Condensers

In radio and television work use is made of a variable condenser, which everyone has seen inside radios. In its simplest form, the variable condenser consists only of two plates, each approximately semi-circular in shape, and so mounted that one of the two can be rotated by an external control. The plates will then face each other over a small area, over a large area or over their whole area, depending on where the control is set; the *effective* plate area of the condenser can thus be varied at will. A number of such sets of plates, so mounted that they are electrically in multiple, constitutes a radio or television tuning condenser, the capacitance of which can be varied at will by rotating an external knob.

The formula also shows that the capacitance of a condenser depends on the thickness of the insulating layer—that is, on the distance separating a pair of plates. To get the greatest possible capacitance out of the smallest possible condenser, it is desirable to keep the insulating layer very thin—but if it is too thin it may be punctured by the voltage of the charge, short-circuiting the condenser. Here the electrolytic type of condenser, a unit of very different physical construction, makes it possible to combine high capacitance with small size and light weight.

In the electrolytic condenser, one of the "plates" is a liquid. The other is a metal, and the insulating material is a film deposited or plated upon the metal by electrical-chemical action. Within limits, this film, although very thin, will not be punctured by application of more voltage. Additional voltage instead will function to sustain and build up the film. There is of course a limit, an extreme voltage, beyond which the film will puncture. Further, the condenser must be wired in correct polarity; for reversing the voltage will break down the layer.

The metal almost universally used is aluminum and the liquid is a solution of a suitable salt—aluminum borate is one. In one form, the condenser consists of an aluminum can, containing the liquid and in addition an aluminum electrode mounted in but insulated from the can. In the factory, a source of current is connected negative to the aluminum can, positive to the aluminum electrode, and an insulating layer believed to be aluminum oxide builds up on the *positive* electrode only. If this condenser were later connected in reverse polarity, the insulating layer would dissolve back into the liquid while a new layer would begin to build up on the other electrode—on the container, in the present example. Meanwhile, however, there would be an interval in which the circuit containing this condenser would be short-circuited.

In other forms of construction two strips of aluminum foil are mounted on either side of a strip of insulating material, just as if an ordinary condenser were to be manufactured; this assemblage is rolled up into a tight cylinder, and the whole immersed in a suitable solution which in turn may be sealed into an alumnium container—but in that form of construction the container is no part of the condenser and need not be aluminum; it may be waxed paper or some other material.

Earlier electrolytic condensers had vents because the insulating layer to some degree dissolved back into the solution when current was switched off, and was to some degree reformed when current was again switched on. In this process, oxygen from the water of the solution went to provide part of the new layer, hydrogen gas being given off. The vents permitted this gas to escape. More modern types incorporate improvements whereby the layer once formed remains in place and does not tend to redissolve in the solution at any time; hence, the electro-chemical action of forming it is finished once for all in the factory and no vent is needed.

Simple water solutions of aluminum salts are now seldom used; modern electrolytes are more in the nature of thick syrups, "gums" or pastes, giving rise to the expression "dry electrolytic condenser." In some, water has no part in the action, alcohol combinations which are almost dry solids taking its place.

Electrolytic condensers for a.c. exist, though little used in the projection room. They have two electrodes immersed in a solution; the solution being always negative and either of the electrodes, positive. The existence of these devices should not mislead the projectionist into thinking that the great majority, if not all, the electrolytic condensers he has to handle are other than d.c. types, needing due care to see that they are always connected in the right polarity.

Voltage Ratings

Because the insulation of all types of condensers will break down if excessive voltage is applied, condensers are always rated as to the voltage they can withstand, as well as their capacitance. A distinction is made between peak voltage and working voltage; and a second and different distinction between a.c. and d.c. voltages.

The "working voltage" of a condenser is that which the device can safely withstand indefinitely. The peak voltage is that which the condenser can withstand momentarily. These voltage ratings will refer either to a.c. or to d.c., not to both. Any condenser is more likely to break down under a.c.

PRAYERS FOR A TIRED DICTATOR

By Dan Parker

(Sports Editor, New York Daily Mirror)

Exhausted from his efforts to improve the human race
By blasting it in toto from this troubled Earth's sad face
With purging showers of bombs that make a Hades of the air,
The Beast of Berchtesgaden has slunk back into his lair.

The job of making orphans is a most exhausting chore
Wholesale slaughtering of hostages can, too, become a bore
And so Der Fuehrer's doctor said, "Your trouble's overwork"
And then prescribed a thorough rest for Germany's Head Jerk.

Ah, me! How few appreciate Der Fuehrer's trying role
Or how a botched-up bombing job, can sear his tender soul!
To plan a coup like Coventry may seem a jolly bit
But the joy can all be nullified by one church left unhit.

The conquest of bleak Norway was a pleasant sort of lark
Yet those stubborn-headed Norsemen keep a-Quisling in the dark
And as for Stalin's legions who were back to Moscow kicked
They're brazenly advancing now, not knowing they've been licked.

Invading Balkan States was fun but think how it disturbs
Herr Hitler to be turned upon now by those ingrate Serbs
And France, how jolly 'twas to watch it's lushest acres burn
Yet, hearken, while the faithless French the world's New Order spurn.

The Poles and Slavs and Czechs enjoyed the blessings of the Blitz
And saw their fathers, brothers, sons and husbands blown to bits
And when Der Fuehrer passed, they didn't flash a single smile
Nor did a single dumkopf know enough to holler, "Heil".

Consider, too, how Adolf's balm was wasted on the Greek
Non-Aryans they, who never learned to turn the other cheek
The Nazi-brand of kultur was to be their special treat
Yet the starving Hellenes turned it down and cried, "When do we eat".

Such crass ingratitude has cut poor Adolf to the quick
Small wonder, therefore, that the mighty man has taken sick
He's showered the world with benefits, yet none will understand
This kindly benefactor, and extend the friendly hand.

Thus, like the lonely eagle which swoops down upon it's prey
E'en as a Stuka bomber, sowing death along its way
Der Fuehrer has sought surcease far above the maddening crowd
With none to keep him company save his conscience and a cloud.

The whole world prays for Hitler, roosting on his towering peak
Like the eagle with its victim's blood still dripping from its beak
As he listens to his conscience in the awful silence there
A billion earthly voices will send up this fervent prayer.

May all the unborn babes, your bombs have cheated out of life
Haunt your every waking hour and give you no relief from strife
May the widows and the orphans you have given cause to weep
Make your dreams a living hell and blot all the blessings out of sleep.

May the souls of all the Poles who died while fighting for their rights
Rain a constant shower of bombs upon your ever-sleepless nights
Bombs that maim and burn and torture you, but somehow never kill
May the awful germs of typhus keep you permanently ill.

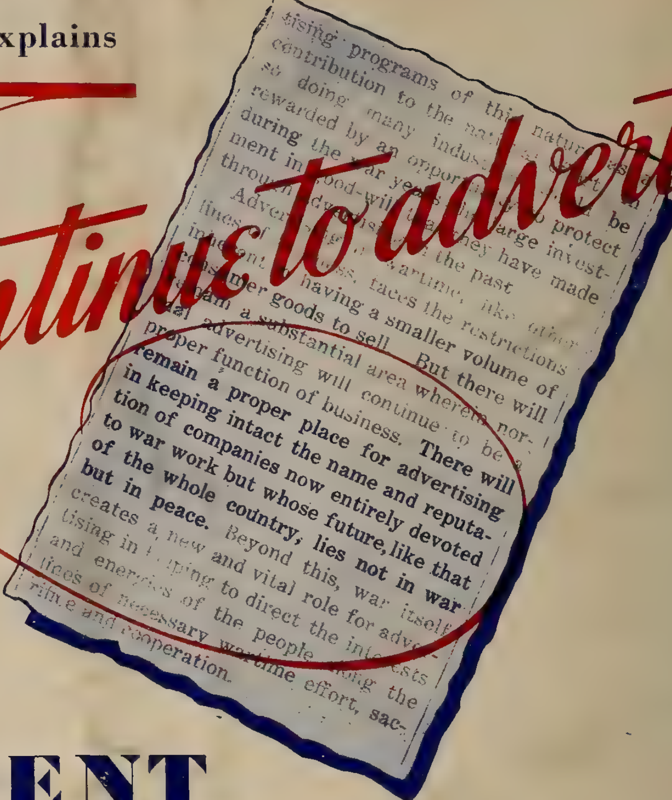
May the French and Dutch and Belgians, whose fair cities you've ransacked
Pound your miserable body until every bone is cracked
May your screeching and your whining, as you howl the Nazi Blues
Be sweet music to the ears of all the persecuted Jews.

And should e'er you have a moment's peace, then may some hapless Czech
Come forward with a red hot spike and drive it through your neck
When tortured by a fiendish thirst that almost cracks your throat
May the gut, who feeds you alkali, be some imprisoned Croat.

Americans all hope 'twill be the least of your mishaps
To be tossed into a cauldron fired by piles of oil-soaked Japs
May your own beloved Gestapo throw you down a poisoned well
That's the prayer of a world which you've converted into Hell.

This Extract from an Editorial in the *"New York Times"* Explains

Why we continue to advertise


consumer goods to sell. But there will
remain a substantial area wherein nor-
mal advertising will continue to be a
proper function of business. **There will
remain a proper place for advertising
in keeping intact the name and reputa-
tion of companies now entirely devoted
to war work but whose future, like that
of the whole country, lies not in war
but in peace.** Beyond this, war itself
creates a new and vital role for adver-
tising in helping to direct the interests
and energies of the people along the
lines of necessary wartime effort, sac-
rifice and cooperation.

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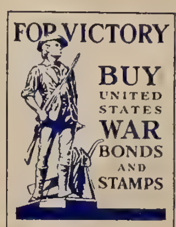
Cooperating with the National Conservation Campaign in our advertising, we are also rendering a service to the Motion Picture Industry by encouraging and supporting trade periodicals publishing technical information which Enables Theatre Owners, Managers and Projectionists to Maintain Highest Projection Standards Under All Conditions.



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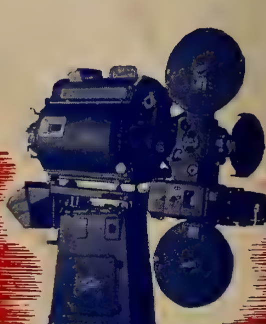

INTERNATIONAL

PROJECTIONIST

AUGUST 1942

VOLUME 17 • NUMBER 8

25c A COPY • $2 A YEAR

International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by Aaron Nadell

Volume 17 — AUGUST 1942 — *Number* 8

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Monthly Chat

THE PROJECTIONISTS of Toronto, Canada, (L. U. 143) have been doing a swell job of education. They throw banquets at which technical experts in every field address the assembled members on fine points of optics, sound and what-not. Toronto has been doing this for 14 years. Arthur Milligan, Secretary of the local, tells about it in this issue.

• • •

And next month I.P. will recount the educational activities of Washington, D. C., Local No. 224, which include maintaining a completely fitted projection room and a small theatre at union headquarters. There is an elaborate system of instruction and examinations for new members. Tom Reed, Business Agent of L. U. 224, says that since the program has been in effect there has never been one complaint of inefficiency against a union member from any exhibitor in the jurisdiction.

• • •

Other locals interested in educational activities may find a point here or there in the practices of Toronto or Washington that they will wish to "borrow." But that works two ways. Perhaps *your* local is engaged in some activity that others would be glad to imitate—if they knew about it. If you think you've got something good why not tell I.P. about it and so pass the word along for the benefit of all the craft? This is your magazine, you know.

• • •

Passing the word along should apply to other things beside organized activities of a local union as such. There isn't a month goes by, probably, but you make some repair, some adjustment, encounter some condition, that is at least a little bit new and different. Why not tell others, for their guidance if they ever run up against the same thing?

• • •

In short, your paper needs just a little cooperation from you, the reader, and hereby asks for it. When a manufacturer or a laboratory develops something new I.P. does its level best to find out about it and pass the word along to you. That's what a craft magazine is for. But all developments don't originate with manufacturers or laboratories. Many good things start right in the projection room—and stop there because nobody ever hears about them. We certainly would like to find out about them, and spread the word for the benefit of others. Just as we'd like to hear about any valuable activities of a local as a group, and spread the news. How about it?

A. N.

INTERNATIONAL PROJECTIONIST

VOLUME XVII AUGUST 1942 NUMBER 8

Educational Activities of the Toronto Projection Society

By ARTHUR MILLIGAN

With interest in local union educational committees growing rapidly under the stress of war conditions, IP here presents a report of the Toronto, Canada, Local Union, No. 143, which has had an unofficial educational committee in action for many years, under the title of Projection Society. The President of the Society, who is also Secretary of L.U. 143 and Secretary-Treasurer of the Eleventh District, I.A.T.S.E., tells the story of the Toronto group's educational activities, and of the results they have achieved.

WE OF Local 173, Toronto, have had a Projection Society since 1928, and this Society was formerly a chapter of the A.P.S.

Toronto projectionists are very education-minded, and are always willing to learn. They are fortunate in having facilities which are not available to the average local union. Manufacturers and distributors of important projection room materials have factories or offices here, which means that the very latest can be seen and a lecture provided. A new lamp, when first placed on the market, is the subject for discussion, and is demonstrated at a lecture. A new projector is dismantled, and explained to the membership.

The district headquarters of the Dominion Sound (Erpi and R.C.A.) are located at Toronto under the capable leadership of H. Golden, who is at all times willing to describe the several changes of circuits, etc., and the accompanying advantages of these changes.

We have the Sound Supervisor of the Famous Players' Corporation, Mr. Cuthbert, who will lecture at any time on Sound or Projection Equipment, and bring the necessary testing equipment to prove his statements. Their Supervisor of Projection, C. A. Dentelbeck, is a charter member of this Society, and will at all times have his top man, T. Hoad, bring projection equipment to a lecture and explain in a practical way the methods of maintenance.

Our real gem is the Chairman of the Educational Committee, Clarence McMahon, who is a university graduate, and a born lecturer. He can make the most commonplace subject interesting. His latest scheme took the form of a quiz, in which five members of the Educational Society, H. Hill, Roy O'Connor, Louis Lodge, C. McMahon and Arthur Milligan, were given articles from the INTERNATIONAL PROJECTIONIST (all pertaining to film and lubrication). The Professors (?) would then answer the questions. With the subjects interlocking, all members agreed that nothing pertaining to oil or film was omitted.

Of course, it is not all smooth riding. You will readily understand that, while these sources are available for lecture material, it requires a certain organized effort to adjust these facilities to a planned program. This is a program having a background of educational principles, in this, that the individual projectionist member should have a fundamental knowledge of the physical values underlying the mechanics of projection.

We hold that, in order to understand the laws of cause and effect, or plain physics, facts cannot be grasped unless the underlying principles are understood, at least in part. This thought resolves itself around a certain skeleton plan which we have labored to establish.

To make this line of thought clearer: we all know perfectly well that there is a revolving shutter on our projectors, but behind this shutter are certain principles of ocular physics. So we asked Dr. Lowrie, an optician, to lecture to us on "Vision and the Human Eyes."

Again, we have a considerable knowledge about oil on film, but not enough. We had (Projectionist) Mr. Roy O'Con-

nor, a Government expert, lecture on cellulose nitrate, acetate, silver and its halogen compounds, and gelatin, as used in the manufacture of film.

The advent of colored photography was met with lectures on the Science of Color. We learned the basic facts of primary and secondary colors, complements, harmony, intensity, tints, shades, value—in fact, the mathematics of color.

In these planned series of lectures we have studied the following: Rectifiers, Amplifiers, Motors, Generators, Magnetism, Sound, Sound Equipment, Instruments, Transformers, The Eyes, Music (by Professor Ayres of New York), Screens, Fluorescence, Photography, Color, Carbons, The Arc, Educational Talks, Quizzes, Roundtable Discussions, New Advances in Equipment, and Circuits. Most of these lectures were illustrated with charts, or demonstrated with actual equipment.

You will begin to suspect that our success is the result of cooperation among the Society's members, and that is just the case. We are all intensely interested and proud of our Society, and each individual is ever willing to lend his assistance for any task. This attitude and enthusiasm is by no means transitory. 1928 to 1942 is considerable proving time to justify our plan.

I have the honor of being President of the Society, and its officers consist of Vice President D. Seigel; Secretary-Treasurer S. Milligan; Convenor Leon Charlip; Lecturer Clarence McMahon; Staff Workers Jack Hill, Roy O'Connor and Louis Lodge. These last three officers are our key men; extremely capable, conscientious to the *n*th degree, and always ready to fill any breach which may occur in our schedule. This, then, is our "official family", while the loyal and unswerving attendance of the membership makes possible the working out of all our plans. It is this spirit which lends substance, promotes vigor and guarantees intellectual growth.

Meetings Held Monthly

Our meetings are held monthly, on the third Tuesday night in the month, at 12 o'clock, in the splendid banquet hall of the Carls-Rite Hotel. We dine banquet style, after which the Chairman asks for order. At this stage, announcements are made concerning the forthcoming lecture, the speaker and the subject. In this manner, we know a month in advance who the speaker will be, and his subject. After these announcements, the speaker of the evening is introduced with seasonal commentary as the occasion would suggest. After the lecture, the Chairman invites an open discussion on the subject, in which all partake with real enthusiasm. Closing the discussion, a vote of appreciation is given to the Speaker, after which the meeting is brought to an end. We have found that in this procedure we lend a dignity and atmosphere, the effect of which is a stabilizing factor in good deportment.

The Society as such has no official connection with the local in any respect. In past times, ventures of this nature have been attempted, but without success. There are always influences that mitigate against such movements, since some members at these times do not see their way clear to become associated with educational work. More often than not, some individuals are only too prone to allow personal taste to motivate their interest, while others are disinterested for reasons private to themselves, and always you have ponderous union machinery to move to institute progressive ideas.

In the manner followed by our Society there is a certain freedom and elasticity, and personal factors that would be lacking if any other method were tried; and, too, there is the natural, unhindered gravitation of men of like mind to come together with undiluted purpose.

That is why we are of the opinion that our Society is a composition of the better type of projectionist. In saying this, I trust I am not stretching the ethics of modesty, but I believe this to be the experience of others as well as myself.

Perhaps through I.P. others will become interested in this field of education. We are appreciative of the honor you have done us, since we regard I.P. as the ultimate in the dissemination of knowledge and progress, and the weld binding together the integral parts of a mighty institution. We regard this publication as something belonging to us personally as part of ourselves, and we have much to be thankful for in its splendid articles, and to those who contribute so unselfishly to its continuation. We are proud to be associated with them.

Some of the members of the Toronto, Canada, Projection Society. Back row, left to right: W. Ayres; A. Miller; B. Crowe; J. Harris; W. North; H. Brooks; L. McBride; R. O'Connor; L. Butler; L. Arnold; A. Kerrin; H. Sharpe (Dominion Sound); L. Charlip; H. Hills; J. Jeffrey; E. Darling, and C. Duhig. Center row, left to right: A. Castrucci; A. Sutton; T. Marsden; Geo. Robinson; A. Milligan; L. Lodge; S. Milligan; C. McMahon; N. Tanner, and E. Whyatt. Lower row, left to right: V. Ayres; A. Massey; A. Hill; P. Cox; R. Stevens; B. Manson; C. Tucker, and J. Shuster.

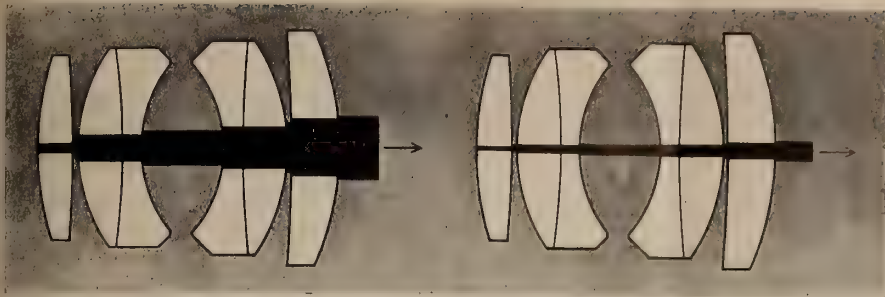


FIGURE 1.—*Reflection losses (left) in untreated Super-Cinephor f:2.0 projection lens without coated surfaces, and (right) in same lens with coated surfaces.*

Projection Lenses with Treated Surfaces

By Dr. A. F. TURNER

SCIENTIFIC BUREAU, BAUSCH & LOMB OPTICAL COMPANY

THE SURFACE treatment to which coated lenses owe their enhanced brilliance is one which creates a very thin transparent film of optical quality over each air-to-glass face of the component lenses. These films must satisfy as definite optical requirements as any other element of a precisely functioning optical system.

Their presence allows each lens surface to transmit more light than otherwise by preventing, to a great extent, the formation of reflections. Any light reflected by a lens surface is obviously not transmitted through that surface, in other words, reflections waste light. One object of the surface treatment is to reclaim, as it were, most of this waste reflected light and to put it to use in the transmitted beam.

Improved transmission, however, is only one aspect of surface treatment. A by-product of equal importance is the increased contrast and crispness imparted to the screen image. Blacks become blacker and colors become more vivid. This is the result of the elimination by the films of reflected light within the lens.

Interference Principle

The principle of the interference of light underlies the behavior of the films. Two light waves which are out of step, or as it is generally expressed, out of phase, weaken each other, whereas two waves which are in phase mutually reinforce each other. The optical characteristics of the surface films are such that rays from the front and rear surfaces find themselves out of phase in the backward or reflection direction and in phase in the forward or transmission direction. Consequently the transmitted light is strengthened at the expense of the reflected light. Thus the films are often referred to either as "anti-reflection" or as "transmission" films.

Although the amount of light normally lost by reflection at a single lens surface is only about 5%, the cumulative loss in a highly corrected large aperture objective becomes considerable. Surface reflections reduce the amount of light transmitted as effectively as an opaque stop covering part of the aperture. This is illustrated graphically in Fig. 1 which shows the loss of light by reflection in a Bausch & Lomb f/2 Super Cinephor projection lens before treatment and after treatment, as it is supplied commercially. The progressively greater width of the black band corresponds to the fractional loss of light by reflection from the original beam in its passage through successive lens surfaces. In all, 33% of the incident light is discarded in this way. Coating reduces this loss to less than one-third of its original value and produces an exactly corresponding gain in screen illumination which amounts to more than 30% for this lens.

It will be apparent from Fig. 1 that the overall loss of light depends upon the number of air-to-glass surfaces. As a consequence the improvement in transmission effected by the coating will be greater for lenses with several air-to-glass surfaces than for those with few. There is practically no loss of light at cemented surfaces and these are not treated.

Fig. 2 shows how the lens disposes of light diverted by internal reflections. It is reflected back and forth between the air-to-glass surfaces until some of it finally emerges from the rear of the lens and flows toward the film gate or slide. The remainder leaves the front of the lens and flows toward the projection screen. Both portions are out of focus because neither has traversed the projection lens in the manner intended by the lens designer. Both tend to obscure contrast in the screen image, the one by veiling the screen with a curtain of haze light, the other by illuminating the film from the wrong side.

Problem of Contrast

The effect on contrast of the first is as detrimental as a projection path full of tobacco smoke. The ill effects of the second come about in this way: The film strip reflects light fairly well over highlight and shadow areas alike. Consequently the scattered light falling upon it returns back to the projection lens and is transmitted to the screen where it contributes materially toward reducing picture contrast.

One may demonstrate this as in Fig. 2. An opaque slide with a transparent sec-

(*Continued on page* 21)

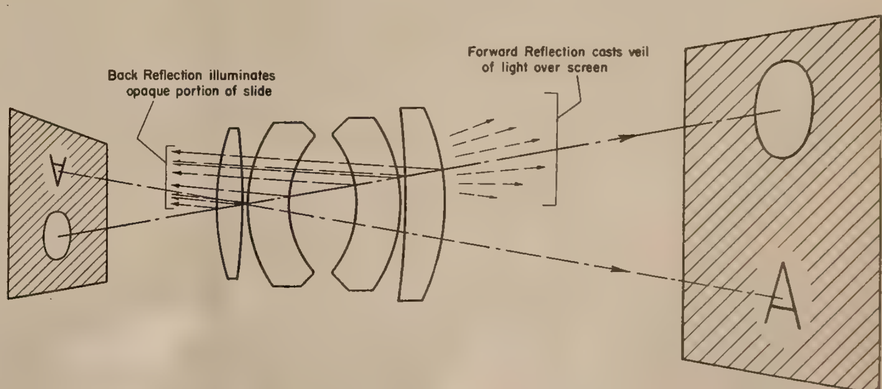


Figure 2

Role of Projectionists in the U.S. Navy

PROJECTING MOTION pictures is one of the most important activities of the U. S. Navy. Almost every ship of the Fleet, and nearly every shore station, is provided with motion picture equipment. There is an elaborate film exchange system. Large numbers of men serve as projectionists.

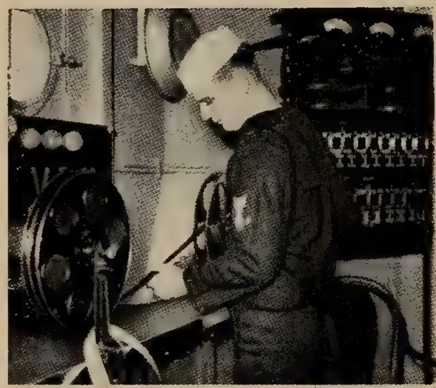
The Navy does not, however, specifically seek enlistment of projectionists as such, and there is no such title or rating in the Navy as "projectionist." The man who puts on the show may be rated as electricians' mate, or he may have no rating at all. The fact that he does projection work has no bearing on his official pay, but he may receive some extra compensation from special funds available for entertainment purposes.

No man can enlist in the Navy as a projectionist. He merely enlists. If he wants to be assigned to projection work, he applies to his commanding officer. He may get the assignment, or may not. If it is granted, the man is sent for training to one of the Navy's "sound motion-picture technicians schools." It does not matter how much he knew about projection in civil life or how many years he spent working at the craft, he must go to school to learn the Navy's way of doing things. A man need not have been a projectionist in the past to be assigned to one of these schools. He may never have seen a projector in his life. He does, however, have to pass an examination in elementary knowledge of magnetism, Ohms Law, Kirchoff laws and vacuum tubes.

Upon graduation from the training school and reassignment to a ship or shore station the individual does not automatically spend all his time at projection work. He performs such duties as may be assigned to him, in accordance with his naval rating. By virtue of having completed the training course he is eligible for assignment to project motion pictures when and as required.

Training Schools

Training schools are located at Brooklyn Navy Yard and at the Naval Training Station, San Diego, California. There used to be a third school in the Philippines, before the Japs took over. The course lasts six weeks and covers "thorough and practical . . . instruction . . . in the operation, care and upkeep of Navy sound motion-picture equipment and film. and in all phases of the service of motion pictures in the Navy." All



Official U. S. Navy Photograph

ships and shore stations draw on these schools for projectionists. "As a precaution against damage to Navy film" no program may be projected by anyone except a graduate, nor may any non-graduate "operate motion picture equipment purchased wholly or in part with Government funds."

Types of Equipment

The equipment used includes both 35 mm and 16 mm sound projectors, slide projectors and apparatus for projecting images of opaque objects. The 35 mm installations are essentially standard types theatre apparatus, equipped to handle 2,000 foot reels, but the lamp is often a low-intensity arc or 1,000 watt or 1,500 watt incandescent bulb, since naval audiences are often much smaller than theatre audiences. The 16 mm equipment is also essentially of standard commercial types. Both 16 mm and 35 mm sound is recorded on film. Sound on disc or phonograph records, still standard in some commercial 16 mm equipment, is not used by the Navy except in some special apparatus developed for instruction by means of films.

Projection apparatus is used for both entertainment and instructional films; the Navy considers both indispensable.

The system of film exchange is complicated by the movements of naval vessels. The Navy Motion Picture Exchange, with headquarters in Brooklyn Navy Yard, is in charge of it. Some 300 feature pictures are leased from producers each year, and reach the Navy about the same time they are shown in ordinary theatres. To secure adequate distribution three prints of each feature were needed in peacetime, six now. Release dates specified by producers are respected; audiences are limited to naval personnel and their families, and casual guests not invited for the sole purpose of attending the show.

The pictures are circulated with a view to providing each ship and station with an opportunity of screening the entire library of programs in the course of a year. Film is sometimes transferred from ship to ship in the Fleet by means of small boats or buoy lines, and the Navy instruction pamphlet emphasizes the need for fastening the latches on film cans very securely so the reel won't fall out and be lost in the water.

These showings are not entirely financed by the government. The Navy Motion Picture Service is intended to be as self-sustaining as possible. Ships and shore stations have welfare and recreation allotments provided by the government; and in addition often earn small profits, from the operation of canteens and the like, which also go to the welfare and recreation funds. Out of these funds assessments of between thirty cents and thirty-five cents per man per month are paid to the Motion Picture Service.

Apparatus, also, is not wholly paid for by the government; ship and shore station welfare and recreation funds contribute to buying motion picture equipment for entertainment purposes. Ship or shore station officers sometimes buy the equipment directly from commercial suppliers; if it is approved apparatus, meeting official specifications, the government may reimburse the ship's fund up to one-half the cost involved.

The Navy considers these entertainment pictures an essential aid to morale. The shipboard motion picture show is a standard institution, never omitted except in emergencies.

Instructional Films

But the Navy has an even higher opinion of the value of motion pictures for instruction. Lieutenant William Exton explained the importance of such pictures to the 1942 Spring Convention of the Society of Motion Picture Engineers. Said Lieut. Exton:

"In the early days of our Navy, the range of battle was virtually point blank, and it took no tremendous skill to aim a gun. The principal skill in battle was that of the commanding officer who, by maneuvering his ship, brought the other ship within range and exposed it to the deadliest concentration of fire. Today huge shells are sent crashing be-

yond the horizon, and the swift dive-bomber or high-altitude bomber is prepared to drop its deadly missiles within a few seconds after first being sighted. Under circumstances like these the humblest sailor must—if he is to justify his place aboard a modern vessel of war—be extremely skilled. . . .

"In times of peace a new recruit was sent to a training station for several months of preparation for duty at sea. He was then placed aboard a ship, where the petty officers above him as well as his commissioned officers would have plenty of time to whip him into shape. He would learn from others by doing, and his drag upon the efficiency of the vessel was not of very great importance.

"Under war conditions, however, such as the present, a vessel newly commissioned, and taking aboard a crew which has never worked together before, may find itself in contact with the enemy in a matter of days. Obviously a wholly green and untrained crew cannot be allowed to go forth in a war vessel, and yet with naval personnel expanded as it has been, many-fold in a very brief length of time, the problem of securing trained personnel—or of training personnel as secured—is a tremendous one. As the number of war vessels in commission increases, the experienced skilled personnel is diluted—being scattered among the large number of vessels. As more and more ships are required for active duty at sea, fewer of them become available for training purposes.

"Thus, though personnel is being expanded beyond all precedent, and the need for training was never greater, there is a smaller number of skilled personnel available to conduct training, and there is less equipment available for use in training. Further to complicate the situation, in a war like the present there is an astounding development of new techniques, of new procedures, new inventions and developments, which require the training of thousands and thousands of men in the use of instruments about which at first perhaps only a very few experts have knowledge.

Films Standardize Training

"The training problems created by these situations are tremendous; and in their solution visual aids are expected to play and are already playing a very important part. I might observe here that one of the most important characteristics that is desired in naval training is standardization. Men who are graduates of the United States Naval Academy have received standardized training, and thus an officer aboard one American war vessel can generally predict what an officer aboard another American vessel will do under a given set of circumstances.

"This standardization of training is of great value. Its value extends down into the field of the skilled enlisted men, since the interchangeability of men is of importance to the efficiency of the fleet; and a man who has learned to do a thing a certain way on one ship and is expected to do it another way upon another ship, will not be giving the Navy the fullest benefit of his experience. If men are taught by other men, there is always the tendency away from standardization, since each individual has his own idea of what should be stressed and how things should be done. However persistently the Navy itself may foster standardization, there is a trend away from standards where teaching is done by individuals.

"Audio-visual aids, however, help to standardize. Since they can be used throughout the Naval service and since they will appear identically to all who see them, they have the most helpful effect in standardizing training. Fur-

(*Continued on page* 17)

Amplifier Breakdowns Averted By Use of Pilot Lamps As Fuses

By
WALTER DUNKELBERGER
MEMBER, L.U. 510, FARGO, N. DAKOTA

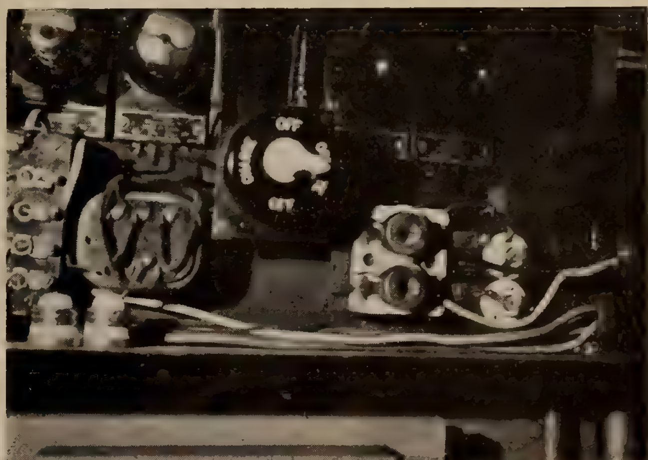
HERE is another "tip" that may not be new, but if I had known of it and made use of it, it would have saved a show for my relief man one night.

In many amplifiers there is a block (tap or connection) located close to the main fuse block (in the amplifier). This block has taps which connect the amplifier's filter condensers in the proper manner. By removing either or both of the connections on this block you disconnect their respective banks of condensers. When one of the condensers in either of these banks goes it shorts out the amplifier, causing a shut-down until one or both of these "disconnect loop" taps are disconnected.

Of course the break in your program is annoying to the audience. Recently a condenser went out while I was off duty and before the man on duty could remedy the trouble the house had almost emptied. When the Altec Man, Nick Fiore, arrived I went over the situation with him and we settled on doing the following: Disconnect the taps and place a pilot light (.25 amp. radio pilot light) in series between the tap itself and the wire just disconnected from it. Of course we placed a miniature socket in series, with the bulb in the socket.

Now when the amplifier is on, the pilot light for the first bank of condensers will glow. If the first bank is working properly the light for the second will not glow as the current passing through it is too small. If the first bulb is unscrewed from its socket it will disconnect its bank and the second will have to do the job alone. You can readily see from the above that should anything happen in either bank of condensers the pilot light will act as a fuse and cut out the whole bank, thereby eliminating the trouble *without a shut down*. Of course the pilot lights will have to be checked occasionally to see if the banks are functioning properly.

The little gadget just described will save many an anxious moment and probably many miles for service men if it's generally known.



Pilot lamp porcelain sockets mounted to right of amplifier's fuse block.

In The

SPOTLIGHT

By HARRY SHERMAN

WE HAVE just learned that certain night clubs are eliminating flesh entertainment and substituting entire shows of shorts and feature pictures on 16 mm film, thereby doing away with the regulations of a projection booth. This matter has been taken up with the local union officials in a large city in the East where one night club in particular seems to have started this vogue. The union officials are now checking the situation and are making every effort to place their men to work running these projection machines. All business agents should be on their guard that no picture show, whether 16- or 35 mm, is run in their jurisdiction without a union projectionist. The 16 mm field is much larger than many of us suspect (*I.P. July*, 1942) and is constantly expanding. Many of our unemployed members can be gainfully employed in this field.

● Give credit where credit is due; and by the same token, if due credit is not given—take it. We are constantly reading in the daily press of the plaudits given the actors and actresses for their untiring efforts in bringing entertainment to the boys in the armed forces. This praise they richly deserve, it is true, but how about our own boys, the projectionists? I have not read one single line where a projectionist or a projectionist organization was credited with providing the armed forces in the many camps throughout the country with entertainment. No, I take that back—I did read some time back that a mayor in a small town in one of the Aleutian Islands stated that the motion picture projectionists in his town stuck to their posts during an air raid, and continued with the show. To these men we take off our hats.

● Walter Dunkelberger, member of Fargo, North Dakota Local 510, and chief projectionist at the Isis Theatre, is the officer in charge of morale units for the Cass County Civilian Emergency Council. From all reports Walter is doing a swell job.

● There are many I. A. locals throughout the country that have no affiliation with their State Federation of Labor. Every local in the Alliance owes it to its membership to become so affiliated and to take active part in the deliberations of the Federation. Take a tip from the "Big 6" of our own 7th District; they are all for one and one for all. UNITY is the keynote of unionism!

● A newcomer in any field is subject to criticism and this writer is no exception. Constructive criticism is always welcome, but when a certain projection "expert" who never in his life touched a projection machine, takes it upon himself to criticize the work of others in this field, then we see red. As for the readers of this magazine, please do not expect to find herein the writings of Keats, Shelley, Lamb, or Coleridge. The writer is just a projectionist who did not attend Yale University, but who, after more than a quarter of a century in this field, happens to know a little bit about motion picture projection and its ramifications. As for the labor angle, we will let the rest of the industry decide that point. If you have any criticism to make that will benefit either the craft of this magazine, (eliminating the personal angle), let's have it. We can take it.

● INTERNATIONAL PROJECTIONIST congratulates John Gatelee, member of Local 86, Springfield, Mass., on the arrival of a baby boy at his home. Mother and child are well—and so is John.

● Under the able leadership of Arthur Martens, president, and Dick Hayes, business agent, Westchester County Local No. 650 is one of the most progressive local unions in the Alliance. The combination of the Martens-Hayes foresight and business acumen is in a large measure responsible for the excellent working conditions in that territory. We might mention in passing that Local 650 pays the union dues and insurance premiums for members serving with the armed forces. By the way, the very last act of mine as Assistant President of the I.A. was the granting and installation of the charter for Local 650.

● Never in the history of the labor movement was it more important to solidify one's labor organization than at the present time. Internal strife in any organization is a cancer, and if permitted to grow will eventually destroy it. Are you one of the men who attend union meetings regularly and sit by quietly while the session is in action, making neither suggestions nor offering constructive criticism? Then, when the meeting is over, do you and your fellow members congregate in your favorite coffee shop and tear your union officials to shreds? If the answer is 'yes' then you are not helping to build up your organization, but you are tearing it down! Good union members recognize this type—they can be found in most locals—they should be won over to work FOR the local, or they should be classified as dangerous to organized labor. This item is not meant for any local in particular—it is addressed to every local in the Alliance.

● Harvey V. D. Post, member of Local 164, Milwaukee, Wis., has given up his projection job to don the uniform of Uncle Sam. A salute to you, Harvey.

● Elsewhere in this issue appears an article by Arthur Milligan, Secretary of Local 173, Toronto, Canada, describing the work of the Projection Society, an organization formed by the members of his local. Arthur's article should encourage other progressive union officials to form similar organizations within their jurisdiction.

● My secret agent advises me that Harry Alexander, who represented Local 226, Waco, Texas, at the recent I. A. Convention, has just returned home from the convention sans report. Harry arrived home in style wearing a valuable hat, but he does not remember where he got it. Page Nick Carter.

● A rally for the United China Relief was recently held in Times Square, New York City, and an address was made by Herman Gelber, prexy of Local 306. James W. Mead, junior Senator from the state of New York, wired the Film War Service Council commending the theatrical unions "for their splendid support in behalf of the United China Relief." Senator Mead has the endorsement of President Roosevelt for the

Governorship of the state of New York. He may also get the backing and support of the American Labor Party.

● Paul Harris, member of Local 650, Westchester County, N. Y., is now with the National Guard, and is expected to arrive shortly at Camp Smith, Peekskill, N. Y. for manoeuvres.

● The controversy between Local 250, Salt Lake City, Utah, and the manager of the Star and Lake Theatres has finally been settled. We are always glad to hear such news—good luck, Local 250.

● So specialized has the profession of baseball become that only highly trained experts are qualified to enter this field of sports. The high standards set for baseball players are also the qualifications one finds in the executives of the various baseball clubs. The appointment of Lewis Mumaw as Traveling Secretary of the Cleveland Baseball Club has met with the unanimous approval of national sports writers. Lew's job as liaison man for the club in its relations with the press and the public is but one of his many duties. He is the editor of "Indians' Information," a four-page leaflet published by the ball club; he oversees the off-field activities of the ball players while on tour, and is in complete charge of transportation and accommodations. Lew is very popular with the players, and Lou Boudreau, manager of the club, is his personal friend. He

Lewis Mumaw

began his career the hard way—as a theatre usher, with occasional pot-shot jobs as ticket seller at the Cleveland Ball park. What brought all this on? I almost forgot to mention that Lewis Mumaw is a motion picture projectionist (good one, too) when not traveling with the ball club, and is a member of Local 160, Cleveland, Ohio.

● All this hullabaloo about inflation being the direct result of a slight increase granted to union labor is just so much hooey. When all is said and done, labor is not permitted to sit at the festive board when bonuses and dividends are being passed around, but has to be satisfied when an occasional crumb is thrown its way. Despite the price ceilings, the cost of living is still on the upgrade—ask your wives, they know. Many years ago Abraham Lincoln had this to say on the subject:

"It is assumed that labor is available only in connection with capital; that nobody labors, unless somebody else, owning capital, somehow by the use of it, induces him to labor. This assumed, it is next considered whether it is best that capital shall hire laborers, and thus induce them to work by their own consent, or buy them and drive them to do it without their consent. Having proceeded so far, it is naturally concluded that all laborers are either hired laborers or what we call slaves. Now, there is no such relation between capital and labor as here assumed . . . Labor is prior to and independent of capital. Capital is only the fruit of labor, could never have existed if labor had not first existed. Labor is the superior of capital, and deserves much the higher consideration."

● Our condolences to Pete Reggio of Westchester County Local 650, who is at home undergoing treatment on his foot for osteomyelitis. Pete is one of the ace projectionists at the Paramount Theatre in Peekskill.

● When back stage, or in any part of the theatre, pick up and send to the proper authorities in your city any bit of scrap metal lying around unused. Discarded brass cuspidors, pieces of old wire, broken display frames, brass posts, worn and unusable parts of projection machines, lamps, spots, broken seats, and rubber mats are all essential materials so necessary to our war program. The little yellow men threw the 6th Avenue El back at us at Pearl Harbor—in retaliation, let us paste them in the puss with a few broken-down picture theatres.

● Charlie Crickmore, member of both local unions in Seattle, Wash., and one of the two remaining former Assistant Presidents of the I.A.T.S.E., has been retained by Mayor Devin, of Seattle, as a member of the censorship board. Charlie is one of the pioneers of this industry, and has the respect and good wishes of all who know him.

● Harry Brooks, of Local 285, Troy, New York, has just been re-elected president of his local for the 32nd consecutive time. He is also business agent of his local, having held that office for the past 15 years. This, we believe, tops all records. We always considered the Barrows-Burke combine (Local 182, Boston) to be the record-holder with their 25th election, but first place must now be given to Brooks. In addition to his duties as president and business agent of his local, Harry holds the following offices: Secretary-Treasurer of the New York State Projectionists Association; member of the Tenth District Executive Board; member of the Executive Board of the Community Chest; Trustee of the Labor Temple Association. He serves on the Board of the Council Social Agency; is a board member of the Civilian Volunteer Defense Participating

Harry Brooks

Council; member of the board of the USO; Trustee of the Masonic Temple Association; member of the Building Committee of the Masonic Temple; Treasurer of the Troy Elks; Treasurer of the Shrine (was Potentate of Oriental Temple in 1939); is an officer of the Royal Order of Jesters No. 122; president of the Northeastern District Bowling League (Elks); and in his SPARE time dabbles in local politics, having been elected Assemblyman in 1926. (Wonder what he does between meals?) Harry has been a member of the Alliance since 1898, and is an organizer and charter member of his local. If you know of any I. A. man who can beat this record, let's hear of it.

● Elsewhere in this issue there is reproduced a letter from a young lady who objects to my warning, last month, that it is dangerous to trust the serious responsibility of a projectionst to a member of the emotional sex. To prove that she is *not* too excitable for the job, the lady writes: "My emotions soared to top-notch after reading your article." Um-hm. And if that's how my fair correspondent reacts to a mere article in a magazine, what would her emotions do in a real theatre emergency? Tear the theatre down?

● Beginning with the September issue of I.P. our "At Your Service" department

(*Continued on page* 21)

JAMES J. FINN IN THE ARMY

James J. Finn, formerly editor of IP, has enlisted with the armed forces.

Underwriters Code As It Affects Projection Rooms

Every projectionist knows that his equipment and operations, and any changes he may make in his equipment, must meet the Fire Underwriters' requirements. How many projectionists know what those requirements are in detail? IP will reprint from time to time portions of the National Electrical Code that are important to the projection room, and amendments to the Code as they are issued. Herewith is presented the fourth installment, containing more of the wiring rules and the definitions which will be needed for understanding subsequent installments. IP welcomes inquiries on practical application of the Code.

IV.

f. Three-wire Receptacles and Caps. Three-wire attachment-plug receptacles and three-wire attachment-plug caps, in which one terminal may be used for the connection of a grounding conductor, shall have such terminal identified in a manner differing from that specified in section 2009. The other terminals need not be marked for identification.

g. Screw-shells. In the case of devices with screw-shells, the identified terminal shall be the one connected to the screw-shell. This does not apply to those screw-shells which serve as fuse-holders.

h. Screw-shell Devices with Leads. In the case of screw-shell devices with attached leads, the conductor attached to the screw-shell shall have white or natural-gray finish. The outer finish of the other conductor shall be of a solid color that will not be confused with the white or natural-gray finish which is to indicate the grounded conductor.

2009. *Means of Identification of Terminals.* The marking of terminals shall be done by means of a metallic plated coating substantially white in color, as nickel or zinc, or the terminals may be of material substantially white in color. The other terminals shall be of a readily distinguishable different color.

Article 210—Branch Circuits

General

2101. *Scope.* The branch circuits referred to in this article may supply one or more lighting or appliance outlets, or combinations of such outlets, and shall conform to the provisions of sections 2102 to 2175 inclusive.

2102. *Branch Circuit Required.* Every lamp, motor or other appliance shall be supplied by a branch circuit conforming to the provisions of this article, or as otherwise specified in the references in the following table:

	Section
Instruments	93843
Motors	4341 to 4349
Organs	6506
Signal and Control Systems	8006
Signs and Outline Lighting	6007
Sound Recording and Reproduction	6406
Systems under 50 Volts	7204
Theatres and Similar Occupancies	5241, 5286 and 5292

2103. *Motors.* If motors, or motor-operated appliances, are connected to any of the branch circuits described in this article, which also supply lighting or other appliance outlets, the provisions of this article and Article 430 both shall apply.

2104. *Multi-Wire Branch Circuits—Color Code.* A multi-wire branch circuit as referred to in this article is a circuit consisting of two or more ungrounded conductors having a potential difference between them, and an identified grounded conductor having equal potential difference between it and each ungrounded conductor of the circuit and which is connected to the neutral conductor of the system. Branch circuits of any of the types recognized in this article may be installed as multi-wire circuits. If installed in raceways, as open work, or as concealed knob and tube work, the conductors of such multi-wire branch circuit shall conform to the following color code.

Color-Code. Three-wire circuits—one black, one white, one red; 4-wire circuits—one black, one white, one red, one blue; 5-wire circuits—one black, one white, one red, one blue, one yellow. If more than one multi-wire branch circuit is carried through a single raceway the ungrounded conductors of the additional circuit may be of colors other than those specified. All circuit conductors of the same color shall be connected to the same ungrounded feeder conductor throughout the installation.

2105. *Voltage.* Branch circuits of any of the types recognized in this article, supplying lampholders, fixtures or receptacles of the standard 15-ampere or less rating, shall not exceed 150 volts to ground, except as permitted for railway properties by section 1110.

2106. *Taps.* Taps to individual lampholders or fixtures, and taps not over 18 inches long to individual outlets supplying lampholders or fixtures, may be of smaller size than the branch-circuit conductor, but not less than the size of tap specified for each type of branch circuit, provided the load does not exceed the carrying capacity of the conductor.

2107. *Determination of Circuits.* The minimum number of branch circuits shall be determined from the total load as computed by section 2108 and the types of circuits to be used, but the number of branch circuits shall in every case be sufficient for the specific load to be served. The total load shall be evenly proportioned among the branch circuits according to the capacity of the circuits, insofar as practicable. If circuits supply continuous loads, such as store lighting

PROJECTIONISTS MAY BE DRAFTED TO WORK IN WAR FACTORIES

Still in the rumor stage but gaining attention in Washington and among leaders of the motion picture industry, are reports that projectionists among other workers may be drafted to help in direct war production. A new law, giving the War Manpower Commission the right to assign skilled workers to labor-hungry war plants, is now under consideration by Congressional committees, and forms the basis for these rumors.

Observers point out that while motion pictures are regarded as a vital war industry, they are not as vital as plane and tank factories, or shipyards, many of which are now suffering acute labor shortages; and that projectionists, with their skilled knowledge of electricity and optics, and their experience in caring for precision-built machinery, could be very valuable in many phases of war production. The attitude the President will take toward the new program is awaited with interest, and is expected to be decisive.

and similar loads, the load shall not exceed 80 per cent of the branch circuit rating.

2108. *Calculation of Load.* In calculating the load on the basis of watts per square foot, the floor area shall be computed from the outside dimensions of the building, or area involved, and the number of floors. The total computed load shall be the sum of the loads computed in accordance with the following:

a. General Lighting. For general illumination in the occupancies shown in the following table, a load of not less than the "watts per square foot" as specified for each occupancy shall be included for each square foot of floor area:

d. Other Loads and Other Occupancies. For other occupancies and for special lighting and appliance loads, capacity shall be included for the specific load to be served, but a load not less than specified below shall be included for each outlet:

Outlets supplying heavy-duty lampholders ...... 5 amperes
Other outlets ....1½ amperes

e. Exceptions. The minimum loads for outlets specified in sub-paragraph d shall be modified as follows:

1. *Multi-Outlet Assemblies.* Where fixed multi-outlet assemblies are employed, each five feet or fraction thereof of each separate and continuous length shall be considered as one outlet of not less than 1½-ampere capacity; except in locations where a number of appliances are likely to be used simultaneously when each one foot or fraction thereof shall be considered as an outlet of not less than 1½ amperes.

Busways so designed that loads can be connected at any point shall be limited in length as provided for multi-outlet assemblies; except that under conditions of operation where the load will not exceed that permitted for a branch circuit, the authority enforcing this code may permit busways of greater length.

2111. *Receptacles.* Receptacles shall conform to the following:

a. Where Required. Fixed receptacles shall be installed where portable cords are used, except where the attachment of flexible cords by other means is specifically permitted.

b. Rating. Receptacles shall have a rating of not less than the rating of the load served.

c. Interchangeability. Receptacles supplied by circuits of more than 150 volts between conductors shall be of such design that attachment plugs used on circuits of other voltages cannot be inserted in them. Plug-in connections, or other devices for supplying appliances or lampholders from busways of 20 amperes capacity or less, shall not be interchangeable with such devices for use on busways of larger capacity, unless overcurrent protection rated at not exceeding 15 amperes is provided as an integral part of the plug-in connection or other attachment device.

2112. *Heavy-Duty Lampholders.* Heavy-duty lampholders as referred to in this article shall include lampholders of the mogul type, a lampholder of the medium-base type which is an integral part of a single lighting unit having also a heavy-duty lampholder, and other lampholding devices required for lamps exceeding the maximum rating of the medium-base lamp as provided in section 94201.

2113. *Classification.* Branch circuits

(*Continued on page* 18)

Presenting an Example of
Unemotional (?) Femininity

On Page 12 of July's IP Harry Sherman suggested that women are likely to be too emotional for so critical a job as projection. A reply from a fair reader, contending that women are not emotional, is reproduced below.

July 28, 1942

Harry Sherman
James J. Publishing Coporation
580 Fifth Ave,
New York, N.Y.

Sir:

Your Article, "CHERCHEZ LA FEMME" appearing in the International Projectionist Magazine, July 1942, Page 12, 4th Article, at the left of your handsome picture, explains your character more than a story of your life could ever, possibly. Ah! I perceive your perfect disposition, your desire for progress and above all PATRICTISM drips from you as a heavy rain-fall. Your picture staring at me from behind a machine gun or among the Real Fighters in our Army would make me feel proud. That is neither here nor there as the picture is of you (on Page 12) and it is all yours to look upon and admire as you see fit. Do you enjoy mud slinging?

I admire and envy the Spokane Wash. Girl that has been issued her license. I have not as yet been issued a license, but, soon. The license will state I am a Moving Picture Operator, not a PROJECTIONIS-tress. I could even be called a Projectionist or Plain Projection Operator or should I say OPERATORISTRESS? Believe me Brother, some of the dives, Pardon me, Theatres I have entered have been in dire need of good operators, be they male or Female. We have lots of dainty little mice running through our projection room, I rarely notice them. Really the old story of women being afraid of mice is Passe,havn't you heard? Does it make a lot of difference if the Operator is capable, as I have said be the operator Male or Female. You have never experienced Motherhood, how can you say what you will or would not do?

Emotions, Well, that's one on the house. Personally I would like to see you and any other"gentleman" have the same opinion, stationed in this Imperial Valleyfor just the months of June, July and August. Our Projection Room is exceedingly cool at least cooler than the other two in town. However, a constant ninety-five degrees with the Humidity running day by day never going below fourty degrees(do you know what I mean by Humidity)? While you are with us, I should like to have you enjoy one of our more severe earth-quakes. Now is the time for your EMOTIONS--Would you be scared to death, scared to move toward the power switches, would your knees turn to rubber? Well! Emotions be hanged, we would use Common-sense, ever heard of it.

My EMOTIONS soared to the top-notch after reading your Article, But I am not putting my emotions in writing as I don't wish the Postal Authorities or you to put me in jail, as my time is Valuable. The Girl from Spokane had to know many things to be issued a license Harry Sherman can you explain in detailthe Decibel, better known as the D.B. Poor defenseless - exceptionally emotional woman that I am, can. In thorough detail. Don't misunderstand me, this is solely my opinion of you and your article. The Gentleman I work with are really Swell-Guys.

From Adam and Eve, Woman have filled the mens shoes, better all the time. When we have a Lady for President, I shall say President-is-tress. I shal remember your Article,

Sincerely, Thelma Harris

P.S. DID YOU KNOW WE ARE AT WAR. NOT ALL THE PRESENT OPERATORS ARE OVER 65.

MOVIE PIONEER WHO HAD NO FAITH IN FILMS DIES AT AGE OF 96

Casper W. Briggs, motion picture pioneer who predicted film pictures would never amount to anything, and dean of American photographers, died at Atlantic City at the age of 96.

Mr. Briggs introduced, in the year 1875, a form of motion pictures based on a moving magic lantern slide which was projected simultaneously with a motionless slide, thus enabling figures to move horizontally across a fixed background. Lincoln's assassination was represented in this way in magic lantern theatres throughout the country. So was "Ten Nights in a Barroom." A highly popular short consisted of a fixed slide showing a man snoring in bed, and a moving slide of a rat apparently jumping into the man's open mouth.

Briggs refused all offers from the infant motion picture industry which replaced his magic lanterns, insisting that the films would have no future. They flickered, he pointed out, and were in many ways imperfect; not sharp and clear like lantern slides. In later years he maintained that motion pictures won success only because they showed pretty women, and told stories about them.

Briggs is survived by his widow, a son and four grandchildren. He was held in high respect as a photographer, and four years ago was honored by the Pennsylvania Arts and Sciences Society for his pioneer contributions in the field of animated screen pictures.

G MEN ACCUSE AMPLIFIER TUBE WHEN JUKE BOX MISBEHAVES

(From the New York Sun)

The juke box in Charlie Flynn's tavern in West Orange attended strictly to the job of grinding out popular music today, the subversive ghost which had inhabited it having been successfully routed by a Government man.

For a week the box startled Charlie's customers and annoyed Charlie by giving out weather reports and other information of interest to aviators or, possibly, fifth columnists. The announcements could be heard above the blare of the record in play.

Ultimately Charlie concluded that spies had something to do with the case, and notified the police. They in turn, sent a hasty call for the G men.

Undaunted by the presence of the Federal authorities, the juke box continued to give information of interest to the enemy. Some one thought of calling an inspector of the Federal Communications Commission. He found that a defective tube in the loud speaker system had converted it into a short-wave set which picked up broadcasts from the control tower at Newark Airport.

TESTS OF PROJECTION SKILL COMING!

Prizes 'n' everything will go with IP's forthcoming contest on wartime projection; the lucky winners' pictures will be printed in these pages. The contest will be open to all actual projectionists, everywhere. No writing ability or skill of presentation will be required; it will be a genuine test of wits and of knowledge of projection. You will want to compete. Watch for announcement of the details in an early issue of IP.

PROJECTION IN THE NAVY

(*Continued from page* 11)

thermore—and this is extremely important—audio-visual aids can standardize training on a high level rather than on an average level. It cannot be denied that there are good teachers and bad teachers. Some men are skillful in training others, and some men are not quite so skillful in training others. If audio-visual aids to training are prepared by the best available experts, and are properly developed to have maximum value for training purposes, then training through them can be standardized on a very high level . . .

"The proper use of a training film will usually involve its being repeated. Most of the training films that I have seen can best be used by showing them a number of times—perhaps giving the men an opportunity to ask questions or to be lectured to between the showings.

"A fairly complicated film, which gives the men only a rough idea of the subject the first time it is shown, may be very simple and easy to understand after it has been shown several times, and all the questions have been answered, and the subject has been explained. A film which is well conceived and executed will be just as interesting the fourth or fifth time it is shown as the first time, and a new intsructional benefit will accrue from each showing."

The films used in this work are obtained in various ways. Some the Navy makes, using its own cameramen and photographic and sound recording equipment. Some are made for the Navy by commercial producers, on contract, under the direction of a Navy officer. Films produced by the Army, or made by the Research Council of the Academy of Motion Picture Arts and Sciences, and products of the United States Office of Education, all contribute to the Navy's library of instructional films. So do instructional films made by or for industrial corporations, productions of the British government for their armed forces, and films put together by cutting, splicing and editing scenes of one kind or another originally photographed for non-instructional reasons. Thus, the film resources of the Navy for this purpose are varied and extensive. In the words of Lieut. Exton, "they have even developed a series of visual aids which teach the teachers how to teach."

MANY NAT'L THEATRE SUPPLY MEN NOW IN ARMED FORCES

National Theatre Supply Company offices throughout the country have contributed 29 employes to the armed forces to date. Four captains, five lieutenants, one aviation cadet, one sergeant and one corporal are in the list.

UNDERWRITERS CODE

(*Continued from page* 15)

recognized by this article shall be classified in accordance with the maximum permitted rating or setting of the overcurrent device as provided herein. When conductors of larger size than specified are used to provide for voltage drop, the specified rating or setting of the overcurrent device shall determine the circuit classification.

15-Ampere Branch Circuit

2121. *Scope.* In addition to the foregoing general requirements, the 15-ampere branch circuit shall conform to sections 2122 to 2125 inclusive.

2122. *Conductors.* Conductors shall not be smaller than No. 14.

2123. *Overcurrent Protection.* Overcurrent devices shall have a rating or setting not exceeding 15 amperes.

2124. *Maximum Load.* The total load shall not exceed 15 amperes.

2125. *Permissible Load.* A 15-ampere branch circuit may supply only:

a. Lampholders. Permanently connected lampholders of all types.

b. Receptacles. Receptacles rated at not more than 15 amperes supplying:

1. Lampholders of all types.
2. Appliances with individual rating of not more than 12 amperes.

c. Fixed Appliances. Fixed appliances with a total rating of not more than:

1. Six amperes, if the circuit also supplies lampholders or portable appliances.
2. Twelve amperes, if the circuit supplies motor-operated appliances.
3. Fifteen amperes, if the circuit supplies only fixed appliances other than motor-operated appliances.

20-Ampere Branch Circuit

2131. *Scope.* In addition to the foregoing general requirements, the 20-ampere branch circuit shall conform to the provisions of sections 2132 to 2135 inclusive.

2132. *Conductors.* Conductors shall have a carrying-capacity of not less than 20-amperes, except that taps as provided in section 2106 may be of No. 14.

2133. *Overcurrent Protection.* Overcurrent devices shall have a rating or setting of not exceeding 20 amperes.

2134. *Maximum Load.* The total load shall not exceed 20 amperes.

2135. *Permissible Load.* A 20-ampere circuit may supply only:

a. Lampholders. Permanently connected heavy-duty lampholders, or a medium-base lampholder of the porcelain keyless type which is part of a lighting unit connected directly with the permanent wiring and controlled by a switch.

b. Receptacles. Receptacles rated at not less than 15 amperes supplying:

1. Lampholders of heavy-duty type.
2. Appliances with individual rating of not more than 15 amperes.

c. Fixed Appliances. Fixed appliances with a total rating of not more than:

1. Fifteen amperes, if the circuit also supplies lampholders or portable appliances.
2. Fifteen amperes, if the circuit supplies motor-operated appliances.
3. Twenty amperes, if the circuit supplies only fixed appliances other than motor-operated appliances.

25-Ampere Branch Circuit

2141. *Scope.* In addition to the foregoing general requirements, the 25-ampere branch circuit shall conform to the provisions of sections 2142 to 2145 inclusive.

2142. *Conductors.* Conductors shall have a carrying-capacity of not less than 25 amperes, except that taps as provided in section 2106 may be of less capacity but not smaller than No. 14.

2143. *Overcurrent Protection.* Overcurrent devices shall have a rating or setting not exceeding 25 amperes.

2144. *Maximum Load.* The total load shall not exceed 25 amperes.

(To be continued)

SOME FURTHER ADO ABOUT THREE DIMENSIONAL PICTURES

Further improvements in the use of light-polarizing plastics to produce three-dimensional motion pictures, including three-dimensional color pictures, have been patented by a Boston inventor, Edwin H. Land, and assigned to the Polaroid Corporation. These improvements still do not do away with necessity for the audience wearing spectacles (made of Polaroid) in order to perceive the three-dimensional effect.

When light which has been polarized is viewed through a polarizing medium it can be made invisible merely by rotating the viewing medium. By preparing a pair of Polaroid spectacles in which the invisible "gratings" are at right angles to each other and by projecting two different images, each consisting of light polarized at right angles to that of the other, each eye of the wearer of the spectacles can be made to see only one image of the two projected. If the two images have been photographed in suitable relation to each other, the result will be an excellent three-dimensional illusion. If the spectator removes his polarized glasses, he will see only a blur.

One of the new inventions relates to improvements in the manufacture of Polaroid, which, as most projectionists remember, consists of microscopic, transparent polarizing crystals embedded in a transparent plastic. In the new method of production, the soft mixture is spread on smooth, flat surface by a knife-edge operating under heavy pressure. When the film of plastic thus spread out has hardened it constitutes a polarizing medium thinner than those previously available but, according to the inventor, of equal efficiency.

The second of the new inventions extends the use of polarized three-dimensional projection to colored pictures, and is based on the creation of two separate polarized images, each photographed on a three-layered, three-color film. Both films are cemented together to form a six-layer film. When this is projected, an audience wearing suitable spectacles will see a single three-dimensional image in full color, the inventor claims.

B. & L. BUILDS SKY PROJECTOR FOR TRAINING NAVY PILOTS

As an aid in teaching celestial navigation to the rapidly expanding aviation personnel at the Ground School of the U. S. Naval Air Station at Pensacola, Florida, a new star projector has been built by Bausch & Lomb which projects 145 navigational stars on a spherical dome, providing a means of identifying these stars by their position and degree of brightness.

Since the stars appear realistically in the sky through a period corresponding to a 24-hour cycle, instruction is speeded up. Students can use the instrument in the daytime when no stars are visible and it can be operated at night when bad weather obscures the real stars.

ENGLAND WON'T DRAFT THEATRE MEN, FINDS MOVIES VITAL

England will draft no more theatre service men for war duty, having decided that the motion picture industry is indispensable to national morale, reports E. S. Gregg, vice president and general manager of Western Electric Export Corporation, who has just returned from London via clipper plane. His company has received official assurance, Gregg revealed, that the British army would make no further inroads on its technical personnel.

However, Western Electric's repair shop in England is largely devoted to war work, according to Gregg, and every man and woman in W. E. shops and offices is engaged in some form of war activity with the volunteer auxiliary organizations.

BUY U. S. WAR BONDS

Simple First Aid Supplies Essential In the Projection Room

By G. I. SHERMAN, Ph.G.

MEMBER, L. U. 306

In every projection room there should be certain first aid materials and medicines, carefully labeled, and kept in a closed cabinet. These supplies are necessary for first aid in case of accident or injury to projection personnel. They should be adequate to provide for cuts, bruises, scratches, sprains, burns, foreign particles in the eye, faintness, etc.

Materials that should be on hand include:

Sterile gauze squares about 3″ x 3″. For aseptic dressings of wounds.

Gauze bandage, about 1″ *width.* To hold dressings in place.

A roll of adhesive plaster.

Scissors.

Absorbent cotton.

Paper cups. For mixing sterile eye washes, etc.

A medicine dropper.

These materials should be kept medically clean at all times, and replaced as used up or when soiled.

Medicines that should be on hand, *carefully labeled,* include the following items:

Alcohol (Rubbing). Eight ounces. To be used externally to relieve the pain of sprains, strains and bruises.

Aromatic Spirits of Ammonia. Two ounces. Mix one-half teaspoonful in one small paper cup of water (one-half glassful of water) for faintness.

Boric Acid. For eyewash, or flushing foreign particles from the eye. Thoroughly dissolve one teaspoonful of the boric acid powder in one glassful of hot water. Cool and apply with medicine dropper.

Castor Oil or Mineral Oil. For eyewash or flushing foreign particles from the eye. May be used in place of Boric Acid solution. The oil should be sterile. Apply with medicine dropper.

Oil of Cloves. For distracting toothache. A few drops on a bit of cotton inserted into the aching cavity, or rubbed on the gum about the tooth, may give temporary relief from pain.

Burn Ointments. Any of the following: mixture of vaseline and bicarbonate of soda, four ounces; carron oil, eight ounces; boric acid ointment, two ounces; tannic acid jelly, one tube. Apply on gauze square for dressing the burn, to ease pain and prevent infection.

Tincture of Iodine. One ounce. To be used on small injuries, such as cuts and scratches. Because the alcohol in the tincture evaporates, solutions of long standing should be replaced.

GENERAL MOTORS TO USE PICTURE THEATRES FOR EMPLOYES

General Motors Corporation will use motion picture theatres throughout Ohio and Michigan to stage "family" theatre parties for its employes. Feature pictures will be shown. Theatre parties will take place in every town in the two states having a G.M. plant.

TELEVISION PROGRAMS CURTAILED

Television program schedules in the New York area have been cut down for the duration in conformity with the new rules of the FCC.

NEW 50-WATT RHEOSTAT NOW ON THE MARKET

A new 50-watt rheostat, available in any resistance value up to and including 10,000 ohms, has been brought out by the Clarostat Manufacturing Company, Inc., of Brooklyn.

The new rheostat is virtually identical, except in size, with the company's previously-introduced 25-watt unit. The resistance wire is wound on an insulated metal core which distributes the heat at intermediate rotational settings. The resistance element is firmly imbedded in a ceramic housing with an inorganic cement, resulting in a solid thermal mass. A graphited-copper contact shoe rides the collector ring and the winding, assuring two positive sliding contacts. Contact pressure is provided by a helical spring, concentrically mounted about a shaft whose action is evenly distributed by use of a tripod-type contact carrier. The contact is insulated from the metal shaft by a center ceramic insulator, thus providing a "dead" shaft and mounting bushing.

SMPE ANNOUNCES PLANS FOR FALL MEETING IN NEW YORK

Plans for a 3-day meeting composed of eight technical sessions beginning October 27, in New York, have been completed by the officers of the Society of Motion Picture Engineers.

The meeting will spend virtually all its time in reading and discussing technical papers dealing with recent advances in the motion picture art, and the application of the new developments to help the war effort and further national morale.

The gathering is the 52nd semi-annual meeting of the society and will be in charge of William C. Kunzmann, of Cleveland, convention vice-president. The meeting is subject to cancellation if such action is later deemed advisable in the national interest.

One high-light of the meeting will be the 52nd Semi-Annual Banquet and Dance to be held on Wednesday, October 28, at headquarters, the Hotel Pennsylvania.

YOUR SKIN IN SUMMER

Keep it clean. After swimming in a pool, take a warm shower with soap and dry yourself thoroughly with a towel. Dry your feet last and do not use that towel again. Dry thoroughly between your toes.

Learn what poison ivy looks like and keep away from it, especially on a warm day. If you have been exposed, particularly by handling it, wash well with strong laundry soap. A thick paste of soap is a good emergency relief.

Keep it cool. In hot weather, avoid over-exertion. In any weather, be careful to acquire your tan on the installment plan. If you do get sunburned, apply an ointment or baking soda solution on a compress. Drink plenty of water, cool but not ice cold.—BELL LABORATORIES RECORD.

TREATED SURFACE LENSES

(*Continued from page 9*)

tion—for instance a metal plate with a hole—is arranged for projection. On the side of the slide toward the projection lens a mark is made: the letter A in the figure. With a reflection-free lens system this mark will not appear on the screen because it is on the opaque section of the slide and this should project perfectly black. However if the slide is projected with an unfilmed lens the A can readily be seen on the screen. When a filmed lens is substituted the A disappears. In other words the back scattered light from the unfilmed lens surfaces ultimately fills the shadow areas on the screen with light. The damaging effect on black and white contrast is all too apparent.

Color projection also suffers with an untreated lens, not only from degraded contrast, but from diluted colors as well. Scattered light from the lens surfaces contains a mixture of all the colors represented in a frame. Spread over the screen by both forward and back scattering in the projection lens, this mixture tends to reduce the purity of color rendition in the image. All this is eliminated by proper surface treatment of the projection lens, and thereupon the screen picture emerges in all its inherent brilliance and purity.

Projection lenses with surfaces treated for increased transparency were introduced to the profession nearly three years ago and enjoyed immediate popularity. Since that time they have proved themselves worthy of this early recognition and they remain in great demand.

IN THE SPOTLIGHT

(*Continued from page 13*)

will be resumed, due to the splendid cooperation extended by the Altec Service Corporation. This department has proven to be one of the most popular features of this magazine. By the kindness of Messrs. Conrow, Sanford, and Simon, of the Altec Corp., sufficient material will be forwarded to us regularly each month to enable us to carry on with this feature. Other service companies are invited to cooperate along these lines. Due credit will be given them.

● Due to a sudden attack of illness, Murray Smyth, business agent of Local 183, Beaumont, Texas, was unable to attend the I. A. Convention recently held in Columbus. Murray has been making steady progress in his recovery, and his many friends in the Alliance, the writer in particular, are rooting for him. He is one of the most popular union officials in Texas and stands "aces high" with the rank and file down there. Smyth is the chap who really put Beaumont on the map when his local union fought the big shots.

● The printed proceedings of the Ninth Annual Convention of the 6th District has just been received and it is a job well done. We should like to receive the proceedings of all the district conventions, as they keep us posted on the activities of the various members of the Alliance. These reports are very enlightening, and we believe that every I.A. man should read the proceedings of his district conventions so that he will know how well his interests are being taken care of by his elected officials.

BUY UNITED STATES WAR BONDS REGULARLY

Many Projection Materials in WPB Shortage List

The War Production Board's most recent list of materials shortages includes a number of materials widely used in projection rooms of which the supply is inadequate, either for war and civilian uses, or for war purposes alone. Included are aluminum, copper, magnesium, nickel, tungsten, chlorine, bakelite and rubber. All these materials are of course used in projection rooms, either directly or as components of essential apparatus.

Materials also needed by projection rooms and by the war effort, supplies of which are somewhat more plentiful, include mercury, glycol, steel, glycerine and mica splittings.

Carbon black (source of projection carbons) is listed among the plentiful materials recommended as substitutes in any capacity in which they can be useful.

W.P.B. NAMES COMMITTEE FOR THEATRE EQUIPMENT

The War Production Board has named a 12-man committee for the motion picture theatre equipment manufacturing industry. Heading the committee will be Harold Hopper, chief of the Board's motion picture and photographic section.

Members of the committee are: C. S. Ashcraft, Ashcraft Manufacturing Co., Long Island City, N. Y.; Edward C. Cahill, RCA Manufacturing Co., Camden, N. J.; E. W. Hullett, E. W. Hullett Manufacturing Co., Chicago; Albert B. Hurley, Hurley Screen Co., Long Island City, N. Y.; G. L. Carrington, Altec Service Corporation, New York City; William A. Gedris, Ideal Seating Co., Grand Rapids, Michigan; Louis B. Goldberg, Goldberg Brothers, Denver; Walter E. Green, General Precision Equipment Co., New York City; J. E. Robin, J. E. Robin, Inc., New York City; E. J. Vallen, Vallen, Inc., Akron, Ohio; E. Wagner, Wagner Sign Service, Chicago; and E. A. Williford, National Carbon Co., New York City.

W.E. MEN AND FAMILIES HAVE WILD ESCAPES FROM WAR ZONES

Western Electric Export Corporation personnel and their families are back under the Stars and Stripes after romantic war escapes with the company's records from Europe and the Far East.

David Wight, manager of the Singapore office, lost all his personal and family belongings. but brought off a large box containing the company's cash and business records in spite of two ship sinkings in the escape from Java to Australia. Mrs. Wight escorted the company box and her mother from Australia to the U. S., while the former Western Electric office manager joined the Navy and is now stationed in India with the rank of lieutenant.

Mrs. Frederick P. Young, wife of W. E. Export's India office, spent two months aboard a Swedish freighter en route to New York, on a trip which included a mid-ocean stop to rescue 25 victims of a submarine sinking. On the last leg of the trip all passengers slept fully clothed in anticipation of being torpedoed themselves.

Fred Hotchkiss, W. E. distributor of sound equipment for France and Belgium, had to wait in Marseilles while Mrs. Hotchkiss, a Frenchwoman, was smuggled back into German-occupied Paris at the bottom of a cart loaded with vegetables. She had refused to come to the U. S. with her husband without a last goodbye to her parents in Paris, so the French underground movement smuggled her in. While in Paris she saw the R.A.F. blast the factories of the Renault automobile works.

RUSSIA REPORTED AHEAD OF U. S. IN PROJECTION TECHNIQUE

Advances in motion picture projection technology which are still in the laboratory stage in the United States are used in practical theatre operation in Russia, according to G. L. Irsky, Chief Engineer of the Motion Picture Industry of the Soviet Union. In a paper presented to the spring meeting of the Society of Motion Picture Engineers, and reproduced in the June, 1942, Journal of the Society, Irsky reveals that one of the new Russian developments is an electron multiplier amplifier tube combined with a photo-electric cell.

This phototube-multiplier unites the photo-cell, p.e.c. amplifier and voltage amplifier of a theatre into a single tube, the output from which is wired directly to the final, push-pull stage of power amplification.

Operating at 500 volts, the photo-tube multiplier permits construction of a very compact amplifier, Irsky declares, adding that the amplifier is light in weight and easy to service.

Replacing arc lamps, the Russians have developed another device still in the laboratory stage in this country—a high pressure gas lamp. This is a form of fluorescent lamp in which the gas is under very high pressure, producing brilliant illumination. Operating at 120 volts a.c. or d.c., and at 250-300 watts, the new lamp has a brilliancy equivalent to that of a 3 kilowatt arc, according to the Russian engineer. Its average life is 200 hours.

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Showplace of the Nation • Rockefeller Center

THE MUSIC HALL OF FAME

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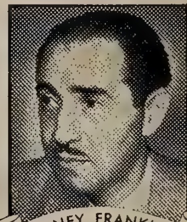
for the FIRST TIME a picture is HELD OVER at the Music Hall for a TENTH WEEK!



SIDNEY FRANKLIN
THE PRODUCER

Acclaimed as one of the ten b[illegible] of all time, "Mrs. Miniver" no[illegible] unic[illegible] position—the first t[illegible] than [illegible] weeks at the [illegible]d's [illegible] Crowds that have set a [illegible] nearly [illegible],000 in ten week[illegible] highest possible tribute [illegible] that went into the making of th[illegible] great picture—[illegible] Sidney Franklin, who [illegible] fresh laurels [illegible] Metro-Goldwyn-Mayer's brilliant [illegible] ... to William Wyler, who [illegible] new [illegible] a master director...and to Jan Struther, whose novel inspi[illegible] motion picture masterpiece.

Simplex PROJECTION

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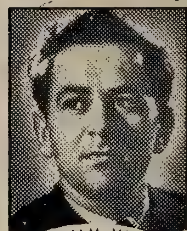


WILLIAM WYLER
THE DIRECTOR

JAN STRUTHER
THE AUTHOR

WALTER PIDGEON and GREER GARSON
THE STARS

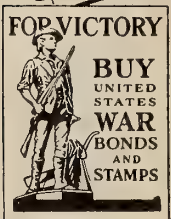
GREER GARSON
WALTER PIDGEON

In WILLIAM WYLER'S Production • Based on JAN STRUTHER'S Novel

"Mrs. Miniver"

TERESA WRIGHT • RICHARD NEY • DAME MAY WHITTY
REGINALD OWEN • HENRY TRAVERS • HENRY WILCOXON

Produced by SIDNEY FRANKLIN • An M-G-M Picture • (Pre-release Engagement)



Simplex PROJECTORS

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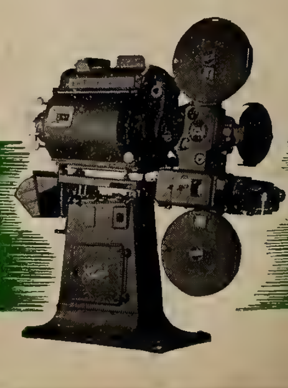
AND THE WORLD'S LEADING THEATRES FOR OVER A QUARTER OF A CENTURY

NATIONAL THEATRE SUPPLY COMPANY

COMPLETE SOUND AND VISUAL PROJECTION EQUIPMENT

Simplex

INTERNATIONAL PROJECTOR CORPORATION



INTERNATIONAL

PROJECTIONIST

SEPTEMBER 1942

VOLUME 17 • NUMBER 9

25c A COPY • $2 A YEAR

A N N O U N C I N G

The New Victory Carbons

Designed to Conserve Copper for War Needs

Winning this war is the first objective of every American. The will for Victory includes taking in stride whatever sacrifice or inconvenience may be occasioned by the demands of our war effort.

Government curtailment of copper necessitates reducing the thickness of copper coating on "National" copper coated high intensity projector carbons. This may result in a slightly longer spindle on the carbons, and in the case of the 7 mm — 6 mm combination, may result in some reduction in screen illumination, although there will still be sufficient light for satisfactory projection.

Fortunately, the culmination of research work on the 8 mm — 7 mm trim makes it possible to burn these new carbons, even with the thinner copper plating, and to obtain even more light with the same current formerly used (within limits of the new maximum). Savings as high as 30% in carbon consumption can be had for the same amount of light on the screen if the present light level is satisfactory. When using power sources designed for "Suprex" type lamps similar savings can be made, while retaining the same screen illumination as formerly, by shifting from 7 mm — 6 mm trims to the new 8 mm — 7 mm. To accomplish this may require enlarging present carbon holders, which can be done with little effort.

Operation at reduced arc current may also, in some instances, necessitate readjustment of the feed ratio of the projection lamps in order to maintain correct position of the carbons with a minimum of manual adjustment.

The trade-mark on these new Victory carbons is imprinted in *white*, instead of the familiar *blue*. Maximum allowable arc current is also stamped on each carbon. It is important that this current limitation be observed.

The words "National," "Suprex" and "Orotip" are trade-marks of National Carbon Company, Inc.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Save the Copper

Most of the copper used for plating copper coated projector carbons drops to the floor of the lamp house when the carbons are burned. Continue to save these copper drippings and turn them over to an authorized scrap dealer or to such other agency as may be designated by our government.

RECOMMENDED TRIM AND RANGE OF ARC CURRENT FOR LAMPS USING COPPER COATED, HIGH INTENSITY, PROJECTOR CARBONS

Type of Arc	*Arc Current — Amperes*	*New Victory Carbons — Size and Type*
"1 Kw" High Intensity, A.C.	52-66	7 mm x 9 inch H.I., A.C. Carbons in both holders
"1 Kw" High Intensity, D.C.	40-42	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *adjustable* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *fixed* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C.	56-65	8 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by Aaron Nadell

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Monthly Chat

ONE OF the most popular features I.P. has ever presented to the craft, that collection of timely and practical data appearing under the title "At Your Service", is resumed with this issue. Old readers will wait to hear no more. To new friends we say—don't miss it.

• • •

Prizes every month, and a grand prize for the best overall showing, feature the contest on wartime projection which begins this month. But they are not the only feature, nor the most important one. The principal purpose of the contest is to bring out ideas on how to maintain projection standards in spite of wartime difficulties. Thus, those who do not win prizes will also benefit—substantially.

• • •

From Cleveland comes the helpful idea of an exhibitor, who has prepared a set speech to be delivered from the stage in case of air raid. This gentleman suggests that all managers of theatres have this speech or a similar one prepared and placed near the stage, where it can be picked up quickly in an emergency and read to the audience at once. Unquestionably the audience will be more effectively calmed by a man who knows just what he wants to say than by one who fumbles and stutters, and we might all toss an orchid to the originator of the idea, George W. Erdmann, secretary of the Cleveland Motion Picture Exhibitors Association.

But what if a manager, in spite of his prepared speech, *is just a bit nervous himself*, and shows it? Would it not be better to have a phonograph record prepared, and played through the non-synch on signal?

• • •

President Roosevelt has proclaimed the week of October 4-10th Fire Prevention Week. With respect to the theatre, even fires of types formerly called "minor" may now be serious, if they damage equipment difficult or impossible to replace.

• • •

Time will tell whether the I. A.-S.M.P.E. cooperation, inaugurated recently to deal with an urgent wartime condition, will continue, and survive into the less strenuous days of peace. Certainly peace will not end all problems; it will bring new ones in a technical sense at least. The industry can hardly lose by the continued friendly cooperation of two of its most important organizations.

A. N.

INTERNATIONAL PROJECTIONIST

VOLUME XVII SEPTEMBER 1942 NUMBER 9

Innovation Ends Buckling of Film

By *LEROY CHADBOURNE*

AN INNOVATION in projection equipment that has ended all trace of film buckling, and reduced the temperature at the aperture from 1,400° F. to 830° F., has been worked out at the Roxy Theatre, New York, through the initiative and energy of the projection staff.

Before the improvement was perfected and installed the heat of the Roxy's huge lamps ruined a film forever after it had been run only a few times. There were quite a few cases of a brand-new print going through a projector just once and coming out useless. Today there is no sign of buckling though the same print is used for weeks.

The projection staff needed and found expert help in connection with important details. John Capstaff, consultant engineer for Eastman Kodak, supplied the key to the problem—it was a suggestion from him that led to the ultimate solution. J. A. Scheick of Bausch and Lomb also advised; Earl Sponable, engineer for Twentieth Century-Fox, at that time operators of the Roxy, gave the project his approval and assistance. The projectionists at the Roxy give these men the credit for the results obtained, but IP learns that the idea originated with the working crews in the projection room—they thought it up, they went to the experts to appeal for special information, and they handled all of the details.

The problem arose in acute form when the Roxy increased the size of its screen to a width of 34 feet, and installed new and more powerful lamps accordingly. The lamps are operated at 180 amperes. And film just curled up.

The Roxy Theatre is one of the largest and most important in New York. It is in the Times Square district, exactly one block from Radio City, and it seats over 5,000. The highest possible quality of projection is indispensable. Yet after a film had been run in that theatre just once it could no longer be made to give a sharp screen image. It was too badly buckled. After a few runnings, if it lasted even that long, the film was fit for the ash-can. The projectionists were forever at the telephone, insisting they must have another new print of this or that feature or newsreel or short.

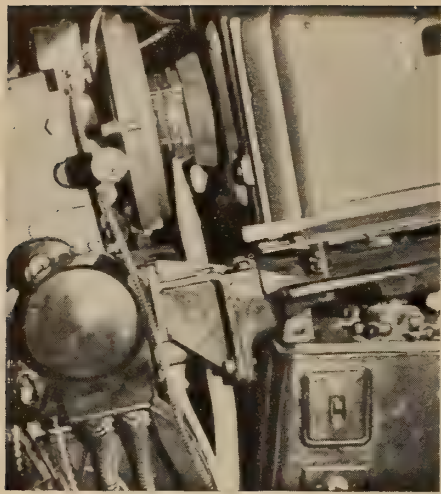
● ***I.P. respectfully commends to those sub-committees of the S.M.P.E. and of the Hays organization which are now studying conservation of film this invention of the projectionists of the Roxy Theatre. By reducing buckling it should save a great deal of film. Its use involves no substantial change in existing mechanisms or practices; and so far from lowering projection standards, would raise them.***

They talked it over. They decided something had to be done and it was up to them to do it.

The idea evolved of inserting some sort of glass filter between the lamp house and the aperture—something that would pass light but stop heat. But if the glass absorbed the heat, instead of passing it along, naturally the glass would crack. A blast of cold air, it was thought, might be used to carry off the heat and keep the glass below the cracking temperature.

It was Capstaff, the Eastman Kodak engineer, who finally suggested the filter that proved the ultimate solution—a product known as Aklo, made by the Corning Glass Works in regular production, and used by Eastman in their slide projectors. But the filters as made by Corning proved too thick for the job; the Roxy projectionists had them ground down to half their original thickness by the Master Optical Company of New York.

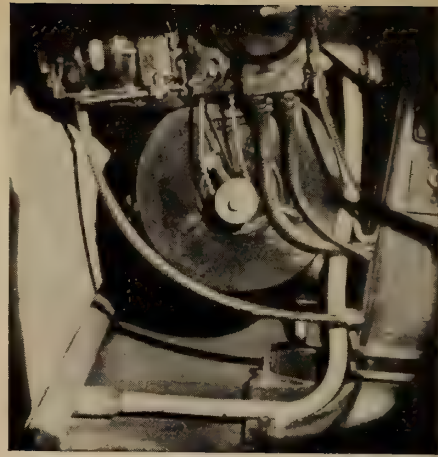
In its finished form the filter consists of two sheets of glass, one the Aklo filter, one ordinary pyrex. They are assembled into a little unit in which they face each other about ½ inch apart. The space between them constitutes a small cooling chamber. This unit is mounted between the lamphouse and the projector, with its pyrex side toward the lamphouse. A blast of air enters the cooling chamber from below, rushes upward between the pyrex and the Aklo, and is exhausted through a ¼-inch slot at the top. None of it is blown either into the lamphouse, where it might disturb the arc, or toward the projector where it might carry dust



Above: Air pump, under the non-synch cabinet.

Left: Heat filter, between lamp and projector. Air duct rises from floor to bottom of filter.

Right: Air distribution system follows projection room front wall.



into the mechanism, but it is harmlessly diffused upward.

The theatre's elaborate ventilating and air conditioning system was found to operate at too low pressure to provide the blast of air needed. Hence a small air exhaust pump was installed in a corner of the projection room and driven in reverse (to serve as a blower) by a ¼ h.p. G.E. motor. A system of small ducts leads around the bottom of the projection room walls to each of the three projectors, carrying air at the rate of 1,000 cu. ft. per minute.

There is some loss of light, of course, as a result of interposing two panes of glass in the light beam. But because of the selective properties of the Aklo filter, the total light loss is only 10 percent while the reduction in heat is nearly 50 percent.

Filters Cost $11 Each

The cost of the Roxy installation cannot be estimated with any significance, since the work was experimental. The Aklo filters, however, cost $11 each, including the charge for grinding them down to half their original thickness.

New York City's Department of Water Supply, Gas and Electricity, which is the municipal agency in charge of projection rooms, has approved the installation. As of course it would, for in addition to other advantages of the device, the lowering of aperture temperature from 1,400° to 830° constitutes an obviously enormous step toward reduction of fire hazard.

The projection crew at the Roxy consists of Frank J. Ruddock, chief; Max Fishler, Samuel Goldfarb, Arthur Jacobsohn, John Janitz, Samuel Kravitz, Francis X. Nealy, Charles Sherman, G. I. Sherman, Solomon Spielfogel and Henry Weinberger. Charles Talley, studio manager, who serves as technical adviser at the Roxy, cooperated closely with the projection crew and did a great deal of the work on this project.

Manpower Shortage Discussed At N. Y. State Projectionists Meeting

THE manpower shortage, its effect on union conditions both during and after the war, and what to do about it, were thoroughly discussed at the August meeting of the New York State Association of Motion Picture Projectionists.

Participating in the discussion were I.A. Vice President James J. Brennan, I.P.'s own Harry Sherman, Delegate Charles F. Wheeler of L. U. 108 and Delegate Glenn H. Humphrey of L. U. 337.

Brennan suggested that men already members of the I.A. be trained to projection work, wherever a shortage of manpower occurs. Thus, locals would not be overloaded after the war. In the event there is no choice but to take in outsiders, he recommended that these be chosen from relatives of I.A. members.

Harry Sherman predicted that unions will have "the battle of their lives" trying to return to present conditions after the war, if those conditions are sacrificed now. He urged that every possible effort be made to maintain existing arrangements.

Wheeler pointed out that large numbers of men who are mechanically inclined have been forced to give up vocations to which they will be only too glad to return when the war ends—filling station men, for example, out of work because of the gasoline shortage. Such men, if beyond the draft age, could be trained to projection work, Wheeler believes, on the distinct understanding that after the war they will return to their former vocations—which most of them will want to do anyhow. Because of their mechanical aptitude and experience, they will learn easily, he suggests.

Humphrey thought that in many locations the situation might be met by men filling in on their day or days off—investing the extra pay in war bonds to avoid financial complications. Where it is necessary to break in new men, he too felt that it would be best to call in relatives of I.A. members. Humphrey agreed with Sherman, that there is grave danger that the present situation may result in an ultimate lowering of established standards.

The policy of the armed services in training unskilled men to projection work was also considered. A resolution was passed, urging the I.A. office to seek establishment of a projectionist classification in the armed service, and assignment to that classification of all professional projectionists when they enlist or are inducted.

P. A. McGuire, Advertising Manager of International Projector Corporation, addressed the meeting on the subject of equipment shortages and the vital importance of educational programs in connection therewith. Every day, McGuire stressed, material to replace present equipment is growing scarcer, and that trend, he emphasized, will continue for the duration. It it of utmost importance that men get everything possible out of their existing equipment.

The Association's President, Fred Boekhout, presided, and introduced the speakers. Others present included Harry M. Brooks, Secretary-Treasurer, a member of Local No. 285; W. H. Colquhoun, Local No. 121; Cal Bornkessel, L. U. 253; Lew Townsend, 253; Louis Goler, 253; Robert C. Griffin, 272; H. Paul Shay, 289; Fred A. Chesbro, 290; Edgar T. Stewart and Morris Kravitz, 306; B. F. Willoughby, 313; Edward Wendt, 324; Robert A. Leonard, 338; Raymond T. Roe, 376; Earl Tuttle, 396; Michael Plunkett, 474; William T. Axton, 524; Dennis F. Harrington, 592; Frank S. Cummings, 640, and Arthur Martens and Richard Hayes, 650.

Educational Activities of Washington, D. C., Local Union No. 224

PAID instructors, ample equipment and a good technical library are among the features of the elaborate educational program of Washington, D. C., Local 224—a program now entering its seventh year. The nature and purpose of this educational activity divide essentially into two parts. One consists of study courses lasting nine months out of each year and intended primarily for newcomers; the other involves an intensive effort by the Board of Education to keep abreast of every new technical development and to make information about it available to the whole membership—this part concerns students in training and old-timers alike.

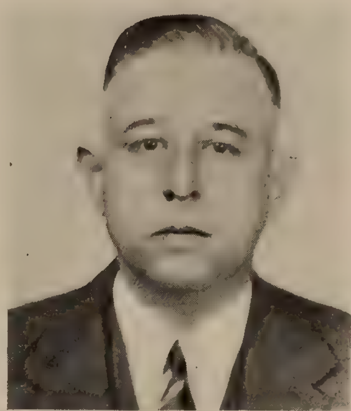
All this educational activity is not only elaborate, it is expensive. But, says Tom Reed, Business Representative of the local: "It has paid for itself a thousand times over."

Educational equipment maintained by the union includes a fully fitted projection room at local headquarters, plus a small auditorium complete with chairs and screen. The trembling newcomer who gets far enough along in his course to project sound pictures on that screen has to satisfy a more critical audience than will ever be gathered in any theatre—he has to put his work before the members of Local 224.

Instructors Are Union Members

The principal instructors are the three projectionists who compose the local's Board of Education. This board is not a voluntary committee which meets once in a while to talk about doing something in education—sometime; these men are union members who are paid by the union to carry out its educational program, and who fully earn their pay. The present Board consists of Walter A. Roth, chairman; David A. Fanning, Jr., secretary, and John De Vries.

Books are another part of the educational project. Among very many other duties, the Board of Education maintains a technical library at union headquarters and keeps it up to date. The Board reports on any new book which it feels each individual member ought to own; the local may then decide to buy the book, ordering it in bulk lots and obtaining a discount, for re-sale to its own members at cost.



Thomas A. Reed, Business Representative of L. U. 224

Classes in Projection

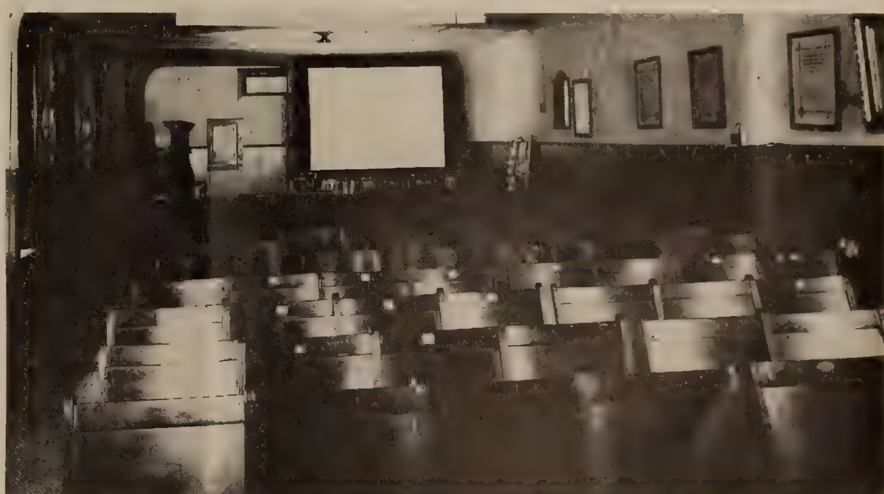
For instructional purposes the Board members divide up the field of projection among themselves, each man specializing in one or more branches, such as optics, projector mechanics, and so on. Instruction in each single phase of projection is given by that Board member who has made the most intensive study of it.

Regular classes for newcomers have been held from October to June each year for the past three years. There are three sessions a week, each session lasting from two to three hours. One class each week is held early in the evening, but the other two meet after midnight. This gives the old-timers a better chance to drop in at the classes—which they are free to do at any time—and refresh their own memory on this or that point of their business. Often enough it works the other way round, and the force of the instruction is enhanced by the old-timer, who contributes anecdotes out of his own experience to the subject under consideration.

The instruction covers every detail of practical projection, from identifying conduit fittings and working with BX to disassembling and repairing projector mechanisms and putting on a show in the little theatre at union headquarters.

Not all students see the whole course through—many drop out before they are graduated. The course is not easy, and it's not made easy for them. The union expects that when a man graduates he will be fit to be sent anywhere to put on a show, and to do a good job of it. He has only nine months in which to learn how, and any student who expected a "snap course" is apt to find the going a bit rocky.

The union also feels that, while its graduates know projection and need nothing more except experience, they still need experience. And that can't be given in school. Hence a graduate is sent to

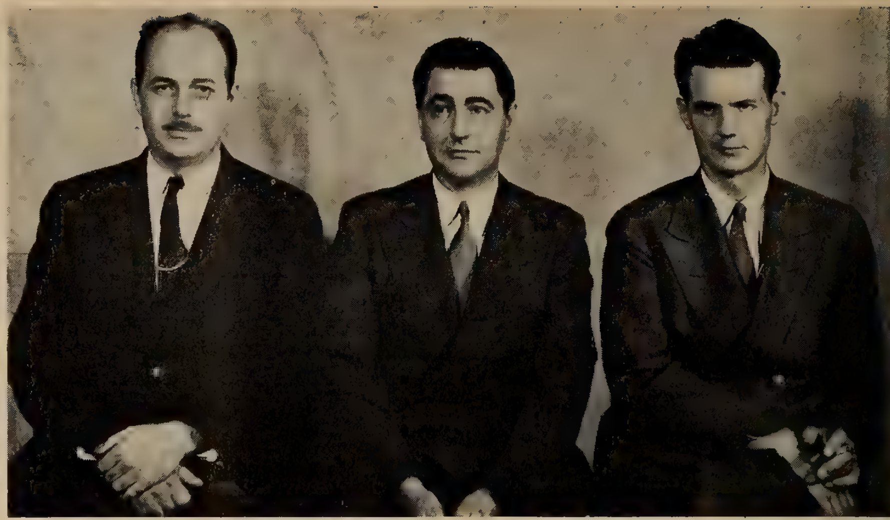


Small theatre, with completely equipped projection room, at Local 224's union headquarters. The chairs, now facing the projection room and lecture platform, are easily reversed to face the screen.

work for six months in some small, outlying theatre. The union holds that during this six-month experience period the student's pay is of no importance. At the end of that time the student is considered a full-fledged projectionist—and a good one, fit to come back to Washington and put on a show for Senators and Ambassadors. Why not? He has put on shows successfully for members of 224, who know more about it.

Many members of Local 224 have been assigned to work for government departments—the War Department, Treasury Department, Department of Agriculture, the Inter-American Defense Board, Lowell Mellett's Bureau of Information, the National Archives, and others. This work for the government is done under union conditions and for union pay, but the men must be highly competent.

Tom Reed says the youngsters are just that; and in some cases even show themselves more competent than some of the old-timers.



L. U. 224's Board of Education. From left to right: David A. Fanning, Jr., Secretary; Walter A. Roth, Chairman; and John De Vries.

New Developments

When some new technical wrinkle is developed, or when a new item of equipment is put on the market, the Board of Education may seek outside help if they think they want it. In the case of new equipment, they often succeed in borrowing a sample of the apparatus from the manufacturer for purposes of demonstration, analysis and instruction. On occasion, a manufacturer's representative may also be borrowed to explain the finer details of the item's construction and operation. At other times local sound engineers may be called on to help out with some knotty points.

The older members—who, as said, are welcome at any time to drop in at any class—attend in droves when some new piece of equipment is dissected by a manufacturer's representative, or when some special detail is explained by other visiting lecturers. By the time all their questions have been answered the explanation turns out to have been pretty thorough.

The full-fledged members of Local 224 pay nothing for their attendance at classes, but the students are not instructed without charge. The Board of Education bill the local for their services; the local pays the bill and prorates the cost among the students. Those students who drop out before a year's course is completed nevertheless must pay for all of it. That is arranged in this way—students are not accepted unless they are sponsored; when one drops out before the end of the school year his sponsor is billed for the fees still due. These do not amount to any excessive sums, however—never to more that $25.

When Business Agent Tom Reed says that the educational program has paid for itself a thousand times over he does not refer to these small fees from the students. The program was established six years ago. For the past five years, says Reed, no exhibitor has ever complained that a projectionist supplied by the union was not efficient. L. U. 224's negotiations with employers are never hampered by *that* argument. "We went to considerable trouble and expense to set up our educational program," Reed says, "but we have never for a moment regretted it."

Students tackle practical projection problems in the Washington local's nine-month course of instruction.

RUDY KNEUER ROUNDS OUT 30 YEARS WITH SIMPLEX

Veteran of projector pioneering and development, R. C. Kneuer, now assistant sales manager of International Projector Corporation, has completed 30 years of service with the industry and with one organization. He joined the Precision Machine Company, now merged with others into International Projector Corporation, back in 1912, and came up the hard way, through the order and repair departments. Kneuer is married and the father of six children, including one son studying for the priesthood and two at present with armed forces.

Rudy Kneuer is widely known throughout the country through his frequent visits to Simplex branches and to many of the theatres using Simplex equipment.

WPB LIMITS SALE OF 35 MM NEGATIVE FILM

Army and Navy motion picture instruction and morale films have cut into the supply of raw negative available for commercial producers, and the War Production Board in consequence has limited sales of negative stock to ordinary studios. Each producer will be allowed to buy as much negative as he used last year, and no more, while production of 35 mm advertising films is banned entirely for the duration.

Review Of Projection Fundamentals

V.—Necessary Formulas

New technical problems will unavoidably be imposed on the projectionist by war conditions. At the same time, he will want to prepare himself for the technical surprises sure to appear when the war ends. In the conviction that our readers will consider the present an ideal time to review their knowledge of fundamentals, IP here presents the fifth of a series of articles dealing with the bases of electricity, optics, sound and other foundations of projection room technique.

CERTAIN VITAL parts of a projectionist's work require him to use arithmetical formulas. There are only a very few formulas he ever needs, and he does not need them often. But when one of them becomes necessary it is indispensable; nothing can take its place.

Ohm's Law is one of those formulas; others are the simple rules for finding the power of a d.c. circuit, for finding the focal length of a projection lens, for figuring voltage drop, for determining a.c. reactance of condensers or inductors, and the formula governing resistors wired in parallel.

Trouble-shooting, repair work, and changes in the equipment of the projection room provide the only occasions when any of these formulas may be needed. Hence they are used but seldom, and are the more likely to be forgotten or half-forgotten when needed.

All of them, fortunately, are simple to use and even simple to remember. There is a great deal of involved mathematics behind them, but that doesn't matter. A great deal of involved metallurgical science lies behind making the steel for a screwdriver. But all the projectionist wants of a screwdriver is to use it. The same is true of the formulas in question, and some of them are almost as easy to use.

Memorizing Ohm's Law

The simplest is Ohm's Law. This is often presented in what appear to be three different forms: $E = I \times R$; $I = E/R$, and $R = E/I$. That is unnecessary. These are not three different formulas; they are the same formula. Men who don't stop to remember their school days may overlook that fact and try to memorize all three forms, increasing the chance of forgetting or confusing them. The above formula need be remembered only in any one of its three forms. The other two follow automatically.

Much the same is true of some of the other formulas to be mentioned later on; therefore in this review it may be worth while to review also what every reader learned years ago in grade school, namely:

In any equation, such $a = b$, the whole statement of fact and the whole secret lie in the equal sign. As long as the little = is kept telling the truth, anything can be done to a. Anything. It is only necessary to do the same to b, so the equal sign will never lie. The reader now remembers learning that long ago. He remembers it is possible to write the same equation as

$$a + 100 = b + 100;$$

or

$$a - 19 = b - 19,$$

or

$$a \times q = b \times q$$

or

$$a/65 = b/65.$$

It doesn't matter. So long as whatever is done, is done equally at *both* sides of the equal sign, the equal sign will keep telling the truth.

So that if Ohm's Law is memorized in the form, say, which reminds us that $E = I \times R$, and we want to know what I equals, just divide both sides of the equation by R. It then reads:

$$\frac{E}{R} = \frac{I \times R}{R}$$

But the R's cancel out at the right side of the equation, because I is first multiplied by R and the product then divided again by R, leaving I where it was; which is the same as saying $4 \times 5 = 20$, and divide 20 by 5, giving 4 again. Thus the R's cancel, leaving the equation: $E/R = I$. By the same process, remembering only the form $E = I \times R$, it is easy to find out that $R = E/I$. Or, reversing the process, if the law is remembered in the last-mentioned form, and it is desired to find what E equals, multiply both sides of the equation by I, thus: $R = E/I$;

$$R \times I = \frac{E \times I}{I}$$

and the I's at the right cancel out, leav-

(Continued on page 18)

In The

SPOTLIGHT

By *HARRY SHERMAN*

ONE of the busiest and most popular men at the recent 10th District Convention held in Rochester, N. Y., was Glenn Humphrey, Local 337, Utica, N. Y. In addition to being business agent of his own local, Glenn is also the Secretary for the 10th District, which takes in the entire state of New York. He did a swell job in organizing the convention and was thanked en masse for his efforts. Glenn is a fine speaker, and has the knack of getting to the point of his address without any unnecessary dilly-dallying, a common fault of many would-be orators.

● Ben Hull, business agent of Local 186, Springfield, Mass., has just been re-elected vice-president of the Massachusetts State Federation of Labor. If I remember correctly, the late John Gatelee, of the same local union, was president of this organization some years ago. We congratulate Local 186 for having in its membership a man of Hull's progressiveness.

● Local 746, Freeport, Texas, has just successfully completed negotiations with the exhibitors in that town by signing up every motion picture theatre, making Freeport 100% unionized. The projectionists were represented by E. J. Miller, I. A. representative, and Keys Hardt, secretary of Local 746.

● In the August issue of I. P. we mentioned the long tenure of office held by Harry Brooks, Local 285, Troy, N. Y. This now reminds us that one of our mid-western locals, No. 355, Sioux City, Iowa, also has a record-holder in the person of John R. Marksbury. Marksbury has been the business agent for Local 355 ever since it was organized—28 years ago. He has proven himself a very able leader and has the respect and high regard of all in his section of the country. Hope to see you again at the next I. A. Convention, John.

● We seem to be bursting with suggestions. Here is another. I.A. local unions throughout the country have contributed very generously to all industry war drives, for which the other fellows always got the credit. Why can't we start a drive that is exclusively I. A., sponsored by and credited to the members of the Alliance? Why not start a drive for ambulances for the fighting Allied forces? If it is too much for each local union to campaign for an ambulance, why not make it a district affair by giving each local in the district a certain quota to fill, depending upon the size of the membership. Each ambulance donated would have painted on its sides "Donated by Local ——, I.A.T.S.E. & M.P.O.U. of the U. S. and C," or "Donated by District No. ——, I. A. T. S. E. etc." It is about time we went on record for our part in the many war drives.

● Louis Mellow, treasurer of Local 84, Hartford, Conn., and former stage-hand at the Capitol Theatre in Hartford, was tendered a testimonial dinner by his former associates on his recent induction in the army. Lou, being a modest fellow, was a bit abashed by the spotlight thrown on him on this occasion.

● The annual election of officers was recently held by Local 597, Waco, Texas. Those elected were H. F. Dunn, president; E. F. Roberts, vice-president; Harry Alexander, business agent; C. L. Helt, secretary-treasurer; Charles J. Keeler, corresponding secretary; and Leslie Yates, sergeant-at-arms. The members of Local 597 anticipate good leadership from the newly elected officers, and there is no doubt but that they will get it.

● William F. Canavan, former president of the I. A., was a recent visitor to New York City. Accompanied by Mrs. Canavan, Bill spent his vacation here and we had the pleasure of spending many an enjoyable hour with him. Bill looks fine and was in swell spirits during his entire stay here. He spent a great deal of his time looking up old friends, and when we visited the I. A. offices it almost seemed like a family re-union. We reminisced quite a bit and Bill's sense of humor hit on all cylinders. We hope he remains in his happy frame of mind for many years to come.

● William C. (Bill) Kunzman, of the National Carbon Company, has been elected an honorary member of the 25-30 Club of Projectionists of New York City. Honorary memberships in the 25-30 Club are not given to many, there being but three others besides Bill's. P. A. McGuire, of International Projector Corp., James Lynette, Chief Inspector, Department of Water Supply, Gas and Electricity for the City of New York, and Bart Greene, his assistant, are the other three honorary members of this club. We expect to be present when Bill gets his gold card, and methinks it will be a night of pretty tall doings.

● Local 361, Kenosha, Wis., has a membership of only 25, but the men have shown a spirit that is truly American. They all belong to the 10% Payday Club; they have purchased bonds for $700 and stamps for $1129. One of their members, Earl J. Roemer, has enlisted in Uncle Sam's army.

● Does anyone remember when Lester B. Isaac, Supervisor of Projection for Loews, Inc., was a delegate to an I. A. Convention and was co-introducer of a resolution asking for the endorsement of

William F. Canavan (center) recalling old times with P. A. McGuire, Advertising Manager of International Projector Company (left) and I.P.'s Harry Sherman.

the citizens of the District of Columbia in their efforts to secure the rights to suffrage and representation in Congress? Ask Lester if he remembers that one.

● Joe Englander, member of Local 306, New York City, is walking around these days with an extended chest. He ran off some motion pictures for King Peter of Yugoslavia at Warners projection room and seems none the worse for having met with royalty.

● The front office employees of the St. Louis film exchanges have been granted a charter by the I. A. and have formed a local known as F-1. This is a result of the recent Warner strike, which was successfully terminated by the I. A. Lou Krouse, General Secretary-Treasurer, granted a charter to the front office employees of the Philadelphia film exchanges also, their local union number being B-7. That is the sort of news we like to hear; let us help our fellow workers in the industry receive a decent living wage and good working conditions.

● Mrs. Elinore M. Herrick, former Regional Director of the National Labor Relations Board, has been appointed director of personnel and labor relations for the Todd Shipyard Corporation. Mrs. Herrick held the office of New York Regional Director of the NLRB since July 1935, and was highly regarded by all labor unions, particularly by I. A. union officials.

● Matt Kennedy, business agent of Local 273, New Haven, Conn., was a recent visitor to New York City. We understand he came in primarily to see the Yankees play ball—hope DiMaggio came through that day with a home run.

● Harvey Hill, business agent of Local 249, Dallas, Texas, is the father of a future admiral. His son, Jack, a student at the University of Houston, has enlisted with the naval forces and expects to see active service in the Pacific shortly. You have our best wishes, Harvey, and we sincerely hope Jack will come back with a couple of the slant-eyed Aryans under his belt.

● Once more on the collection of scrap. A drive for scrap material was started in three theatres in Harrisburg, Penna., with the usual fanfare that accompanies such drives. But unlike the proverbial month of March that rushes in like a lion and dies out meek as a lamb, this particular drive wound up to a finish as strong as the beginning. *Three and one-half tons* of scrap were collected from these three theatres, and this is merely a sample of what can be done when we really buckle down to business. If all the theatres in the country showed the same cooperative spirit, Uncle Sam would soon have all the scrap necessary.

● Stanley Creech, Petty Officer of the Royal Canadian Navy, and a member of Projectionist Local No. 348, Vancouver, B. C., Canada, was a recent visitor to the offices of I. P. A letter of introduction from the secretary of his local union,

Stanley Creech

J. H. (Hank) Leslie, was open sesame for Creech. He visited the projection room of the Paramount Theatre in this city and was deeply impressed with what he saw there; arrangements are being made whereby he will be extended the same courtesies by the other ace picture theatres in New York. He also accompanied the writer to a regular meeting of Local 306 and was introduced to the membership by President Gelber. Creech made a brief talk and was roundly applauded. Petty Officer Creech is a member of the Canadian Naval Reserve and has been in active service since Canada declared war on the Axis. At home, in Vancouver, he worked as a motion picture projectionist at the Strand Theatre in Trail, Tivoli Theatre in Creston, Jewel Theatre in Greenwood, and in his own theatre in Pouce Coupe, all in the province of British Columbia. He is a staunch booster of his local and is proud of his affiliation with it. (By the way, he would like Secretary Leslie to forward his card to him, for he needs it badly).

Creech told the writer of a very interesting ruling affecting all licensed projectionists in the British Navy. Any projectionist licensed by the British Empire and in His Majesty's service in the British Navy, coming to any ship or establishment (barracks) where there is a motion picture projector which is operated by a non-licensed man, is automatically ordered to operate the projection machine on said ship or establishment, for which he will receive an additional 25c per day. This is one of the laws of the Kings Rules and Admiralty Regulations. We should like to see a similar ruling in this country.

● Following the meeting of the New York State Association of Motion Picture Projectionists at Rochester on August 17, the boys all adjourned to the Elks Club, where a dinner and floor show were put on by Rochester Locals 25 and 253 for the entertainment of the visiting delegates and their friends. Burt Caley, Local 25, was toastmaster at the dinner, which was attended by 300 persons. On the dais were seated Fred Boekhout, George B. Kelly, Assemblyman Shulman, Don Rood, John McDowell, P. A. McGuire, Harry Brooks, Glenn Humphrey, Tom Murtha, Solly Pernick, Richard Hayes, Arthur Martens, H. Paul Shay, Harry Sherman, Senator O'Brien, Jimmy Brennan—and Murray Seamon, the "end man". A swell dinner and a fine show ended the convention of the 10th District and the New York State Association of Motion Picture Projectionists.

● The vice-president of the State Federation of Labor and life-time business agent for Rochester Local 25, Mike Mungovan, was the busiest man at the recent dinner given by the New York State Association of Motion Picture Projectionists. The success of the party was due in a great measure to Mike's untiring efforts in seeing that all guests were made comfortable and happy.

● New York City local unions are well represented in the September Billion Dollar Industry drive. The locals taking an active part in this drive are Projectionists Local No. 306, Stagehands Local No. 1, Laboratory Technicians Local No. 702, and Photographers Local No. 644. That these Locals will make the grade and help put the drive over with a bang is unquestioned.

N.T.S. CO. BRINGS OUT BABY "FIRE ENGINE" FOR THEATRES

A miniature "fire engine," called Fyremobile, consisting of a light wooden wagon that carries all needed fire-fighting and first aid equipment and can be wheeled quickly to any part of the theatre, has been brought out by National Theatre Supply Company. It is available with or without the fire-fighting apparatus, and is intended to assure that all necessary appliances, sand pails, stirrup pump, shovels and so on, reach the scene of an emergency without delay and without need for searching for this or that specific item.

PRICE OF FLUORESCENT LAMPS CUT BY GENERAL ELECTRIC

General Electric has reduced prices of its fluorescent lamps, effective September 1st, by from 12 to 17 percent. The company's announcement of the new schedule notes that it marks the seventh major price reduction, on these lamps, in four years; and that it is made in the face of present rising cost trends in other commodity lines.

APOLOGY

Through a regrettable error, I. P. for August repeatedly referred to L. U. 173, Toronto, as L. U. 143. L. U. 143 is the St. Louis local.

Tenth District Unanimously Endorses I.P.

AT THE 10th District (New York State) Annual Convention, which was held at the Sagamore Hotel, Rochester, N. Y., on Sunday, August 16, a resolution was unanimously passed endorsing INTERNATIONAL PROJECTIONIST as the only trade paper in the industry which is devoted *exclusively* to the motion picture projectionist. In the discussion which accompanied the unanimous endorsement of this publication, it was suggested by several of the delegates that a department of the paper be given over to items of interest to stage employees. (*This is being seriously considered.—Ed.*)

Tom Murtha, with the assistance of Glenn Humphrey, 10th District Secretary, opened the convention at 11:30 Sunday morning. At the right of the rostrum hung a large picture of I. A. President Walsh, while at the left was placed a "directory" upon which appeared the following names of labor leaders of the state who were delegates to the convention: Richard Walsh, I. A. president, James Brennan, I. A. vice-president, Tom Murtha, New York Central Trades and Labor Councils, Glenn Humphrey, Utica C. T. and L. C., A. Pigeon, Courtland C. T. and L. C., H. Paul Shay, Elmira C. T. and L. C., Bob Leonard, Watertown C. T. and L. C., and Ed Batey, Poughkeepsie C. T. and L. C. In addition to the 38 delegates present, members of the many local unions in the district were also in attendance.

Murtha made the welcoming address, introducing speakers Hank O'Connell of Rochester, Thomas J. Lyons, President of the State Federation of Labor, Congressman George B. Kelly, and Senator Norman O'Brien, the latter two being honorary members of Stage Employees Local No. 25. P. A. McGuire, advertising manager of International Projector Corporation, delivered a short address on the importance of the conservation plans being put into effect all over the country. The writer also spoke briefly.

Jimmy Brennan as the presiding officer took over while the credentials committee was appointed and retired to an anteroom. The minutes of the last meeting at Columbus, Ohio, were then passed among the members, and Glenn Humphrey read his report, which impressed listeners as concise and pointed. (The proceedings were briefly interrupted while Joe Monaco, Jr., was absent from the room.) Tom Murtha gave the meeting valuable information on the subject of Social Security.

The convention closed at 3 o'clock in the afternoon after passing a resolution in which Brennan was thanked for his fine work as presiding officer.—H. S.

Members of L. U. 193, Bloomington, Ill., now with the armed forces. Sergeant James Condon is in the Air Corps at Scott Field, Ill. His father has been a member of Local No. 193 since 1912. Sergeant James Tucker is at Fort Bragg, N. C. He also is the son of a member of Local 193. Private Eddie Roberds is with the 132nd Infantry, now stationed in the South Seas; his brother, Sergeant Willard Roberds, is at Fort Lewis, Washington. The Roberds brothers are nephews of one of the four remaining charter members. Robert Jones and Wayne Shoup are with the Marines down Australia way; they are the son and nephew respectively of officers of the local.

WITS SEE A MERGER BETWEEN HOLLYWOOD AND THE ARMY

Vine Street wits are saying that Hollywood and the U. S. Army have practically undergone a merger in connection with making educational and training films for the armed forces.

Lieut. Col. Frank Capra has been named commanding officer of the 834th Signal Corps Photographic Detachment, which will occupy the 20th-Century Fox Western Avenue studio, leased to the War Department at $1.00 a year, and make the aforesaid training films. The detachment consists of ace directors, writers and technicians.

Col. Darryl F. Zanuck announced the "merger".

RCA WORKERS "GO TO BATT" FOR MacARTHUR

More than 20,000 RCA employes have signed a pledge to "beat the promise" on war production. The pledge was forwarded to William L. Batt, vice chairman of the War Production Board. "Let's go to Batt for MacArthur" was the slogan of the RCA personnel.

N. Y. STATE PROJECTIONISTS HEAR TRIBUTE TO I.P.

The following is quoted from the official minutes of the Aug. 17th meeting of the New York State Association of Motion Picture Projectionists:

"Secretary Brooks also cited the important part the International Projectionist had played in publishing items that have been of untold value to every projectionist, and have helped us to reach the high standard of perfection we now enjoy. He asked all present to do their best to get their brother members on the subscription list, as all publications require subscriptions, without them the publication goes out of business, and if the Projectionist goes out of business, we will have no source to get valuable information that will keep us up to the times."

Thanks, Harry M. Brooks!

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

HERE IS an unusual case of noise that had me believing I was about to graduate to the "batty" class:

A 5MF-91 System, exciter lamp on, fader at top, a breeze in the booth now and then, and whenever the breeze could be felt, a low rumbling noise in the monitor and stage horn audible above exciter lamp hiss. Well, the wind was causing the noise (it had to be that because it was coincidental with the noise) and the idea that it was had me nuts. Eventually I regained my senses long enough to observe that the circulation of air was affecting the exciter lamp brilliancy by cooling the filament. The effect could not be seen, of course, but since then I have been able to reproduce the effect on other systems by fanning the exciter lamp.—S. J. WARKOCZEWSKI, *ALTEC, Kansas City, Mo.*

• • •

I ran across an interesting case during one of my recent hunts for the elusive hum.

The usual precautions of eliminating grounds between negative leads and conduit in all but one point had been taken, but a test indicated a 15,000 ohm circuit between pipe and negative wire, when the single connection was lifted. This resistance was traced to the TA-4115 condensers in the TA-7276 power unit. Several of these condensers had a high resistance connection from negative terminal to can. These were wrapped in paper and reinstalled in the power unit—the ground was eliminated and the hum level dropped about 10db.—MAX V. NEUMANN, *ALTEC, Los Angeles, Cal.*

• • •

I believe it is a very good idea to fuse the filter condensers in 46-type amplifiers but in RCA and Simplex amplifiers having no meters I have been using a system which gives the protection of a fuse and also indicates normal operation of the amplifier by showing relative amounts of plate current.

A 6-8 volt pilot lamp mounted in a miniature porcelain socket is connected in series with the DC output lead at the rectifier socket. In case of a condenser short the bulb will either burn out or burn extra bright indicating trouble. In case of a weak rectifier or power amplifier tube the brilliancy is reduced. These lamps are rated from 150 MA to 500 MA and the type used depends on the type of amplifier. The bulb should burn at about half normal brilliancy to eliminate replacement. — F. H. RIFFLE, *ALTEC, Louisville, Ky.*

• • •

I have found that use of the theatre's vacuum cleaner as a means of cleaning dust out of amplifier bays and drive motors greatly facilitates same. I have also found that frequent use of this method has resulted in a considerable reduction in operating temperature of drive motors, especially on the universal base equipments where dust and fluff lodges between slots on the generator end of motor and around brush holders. This, of course, prevents circulation of air through the motor. In one case where it was impossible to hold the hand on the motor, I found by blowing the dirt out of the motor that normal operating condition resulted, doing in five minutes a job that would take half an hour or more if motor was dismantled. By using this method on amplifier bays no fear need be had that wires will be broken, and the hard-to-get-at spots are also taken care of.—V. SHARP, *DOMINION SOUND CO., Montreal, Quebec.*

• • •

Sometimes a trouble which eventually turns out to be insignificant may cause a lot of worry and take up a lot of time before it can eventually be located.

This condition was the cause of a recent call which stated that the 12-B rectifier had been inoperative for some time and that they had been running on batteries. Changing tubes did not seem to remedy the trouble.

After considerable probing around I saw that one of the plate prongs on the 83 tube in the 12-B rectifier was not making contact in the socket due to the fact that the tube was probably put in a revolved 90° position so that the larger filament prong spread the smaller plate socket contact to such an extent that contact could not be established when righted.

When the exact trouble was discovered it was easily eliminated by squeezing the socket contacts together and re-inserting the rectifier tube.—C. C. KAUFMAN, *ALTEC, Charlotte, N. C.*

• • •

This incident is submitted as proof that telephone instructions for clearing trouble calls can and do turn out to be satisfactory.

Not so long ago I received a call from the manager saying that the rheostat which controls the arc generator had opened up. Inasmuch as I was more than 100 miles away, I gave instructions on the phone to have the operator connect a jumper wire between the two terminals of the rheostat, thereby shorting it out and allowing time to continue the show until my arrival before the next show time.

Upon my arrival, I found that the projectionist had gone me one better and had removed the burned section of the rheostat and connected the good section to the terminals which allowed the rheostat to carry on with satisfacory operation.—C. R. ARCHER, *ALTEC, Bangor, Maine.*

• • •

Some time ago, the writer had occasion to investigate a complaint of radio transmitter interference in a theatre in the southern part of Virginia. The transmitter at the local radio station was on the roof of the building in which the theatre was located. Since the transmitter started operation, the sound system picked up radio signals which badly interfered with sound reproduction in the theatre. After trying various combinations of chokes, condensers, etc., in connection with technical information contained in bulletins and other information of Altec's, covering radio interference, the signals were eliminated by grounding the neutral wire of the AC supply in the 7276 power unit to the case of the power unit.

This was rather an odd way to clear this type of interference but it was undoubtedly due to the fact that the theatre system ground was underneath the stage and was connected to the booth sound system ground by a wire in the stage run.—D. A. PETERSON, *ALTEC, Philadelphia, Pa.*

Underwriters Code As It Affects Projection Rooms

Every projectionist knows that his equipment and operations, and any changes he may make in his equipment, must meet the Fire Underwriters' requirements. How many projectionists know what those requirements are in detail? IP will reprint from time to time portions of the National Electrical Code that are important to the projection room, and amendments to the Code as they are issued. Herewith is presented the fifth installment, containing more of the wiring rules and the definitions which will be needed for understanding subsequent installments. IP welcomes inquiries on practical application of the Code.

V.

2145. *Permissible Load.* A 25-ampere branch circuit may supply only:

a. Lampholders. Permanently connected heavy-duty lampholders.

b. Receptacles. Receptacles rated at not less than 20 amperes supplying:

1. Lampholders of heavy-duty type.
2. Appliances with individual rating of not more than 20 amperes.

c. Fixed Appliances. Fixed appliances with a total rating of not more than:

1. Twenty amperes, if the circuit also supplies lampholders or portable appliances.
2. Twenty amperes, if the circuit supplies motor-operated appliances.
3. Twenty-five amperes, if the circuit supplies only fixed appliances other than motor-operated appliances.

35-Ampere Branch Circuit

2151. *Scope.* In addition to the foregoing general requirements, the 35-ampere branch circuit shall conform to the provisions of sections 2152 to 2155 inclusive; and shall not be used to supply portable appliances.

For portable appliances rated in excess of 20 amperes see "Individual Branch Circuits"—Sections 2171-2175, inclusive.

2152. *Conductors.* Conductors shall have a carrying capacity of not less than 35 amperes, except that taps as provided in section 2106 may be of less capacity but not smaller than No. 14.

2153. *Overcurrent Protection.* Overcurrent devices shall have a rating or setting not exceeding 35 amperes.

2154. *Maximum Load.* The total load shall not exceed 35 amperes.

2155. *Permissible Load.* (See section 2151). A 35-ampere branch circuit may supply only:

a. Lampholders. Permanently connected heavy-duty lampholders in other than dwelling occupancies.

b. Receptacles. Receptacles rated at not less than 30 amperes supplying:

1. Lampholders of the heavy-duty type in other than dwelling occupancies.
2. Appliances other than portable.

c. Fixed Appliances. Fixed appliances with a total rating of not more than:

1. Twenty-five amperes, if the circuit also supplies lampholders.
2. Twenty-five amperes, if the circuit supplies motor-operated appliances.
3. Thirty-five amperes, if the circuit supplies only fixed appliances other than motor-operated appliances.

50-Ampere Branch Circuit

2161. *Scope.* In addition to the foregoing general requirements, the 50-ampere branch circuit shall conform to the provisions of sections 2162 to 2165 inclusive. The 50-ampere branch circuit shall not be used to supply lampholders in dwelling occupancies, nor to supply portable appliances or combination lighting load and appliance load in any type occupancy.

For portable appliances rated in excess of 20 amperes see "Individual Branch Circuits"—Sections 2171-2175, inclusive.

2162. *Conductors.* Conductors shall have a carrying capacity of not less than 50 amperes, except that taps as provided in section 2106 may be of less capacity but not smaller than No. 12.

2163. *Overcurrent Protection.* Overcurrent devices shall have a rating or setting not exceeding 50 amperes.

2164. *Maximum Load.* The total load shall not exceed 50 amperes.

2165. *Permissible Load.* (See section 2161.) A 50-ampere branch circuit may supply only:

a. Lampholders. Permanently connected heavy-duty lampholders in other than dwelling occupancies.

b. Receptacles. Receptacles rated at not less than 50 amperes.

Individual Branch Circuits

2171. *Scope.* In addition to the foregoing general requirements, the individual branch circuit, except branch circuits supplying motors and motor-operated appliances, shall conform to the provisions of sections 2172 to 2175 inclusive, and shall be used to supply only a single outlet or appliance. For motors, see Article 430.

2172. *Conductors.* Conductors shall have a carrying capacity sufficient for the load which they supply.

2173. *Overcurrent Protection.* Overcurrent devices shall have a rating or setting not in excess of the carrying capacity of the conductors of the circuit and not exceeding 150 per cent of the rating of the appliance.

2174. *Maximum Load.* The load shall not be limited.

2175. *Permissible Load.* An individual branch circuit may supply only:

a. Lampholders. A single lampholder or lighting fixture.

b. Receptacles. A receptacle supplying:

1. A single lampholder or lighting fixture.
2. A single appliance of any rating.

c. Fixed Appliances. A single fixed appliance of any rating.

Article 220—Feeders

2201. *Feeder Size.* A 2-wire feeder for two or more 2-wire branch circuits, or a 3-wire feeder supplying in excess of two 2-wire branch circuits, or two or more 3-wire branch circuits, shall be not smaller than No. 10. If a feeder carries the total current supplied by the service-entrance conductors, such feeder shall, for services of No. 8 and smaller, be of the same size as the service-entrance conductors.

2202. *Voltage Drop.* The size of the feeder conductors should be such that voltage drop up to the final distribution point for the load will not be more than 3 per cent for power loads, and not more than 1 per cent for lighting loads or combined lighting and power loads.

e. Neutral Feeder Load. The neutral feeder load shall be subject to the provisions of section 2204.

2204. *Neutral Feeder Load.* The neutral feeder load shall be the maximum unbalance of the load. The maximum unbalanced load shall be the computed load less all loads tapped from the ungrounded feeders and not connected to the neutral; except that the load thus obtained shall be multiplied by 140 per cent for 5-wire two-phase systems. For 3-wire D. C. or single-phase A. C., 4-wire three-phase and 5-wire two-phase, a further demand-factor of 70 per cent may be applied to that portion of the unbalanced load in excess of 200 amperes.

(To be continued)

First Aid for Burns

By *G. I. SHERMAN, Ph. G.*
MEMBER L. U. 306

Burns: Too severe an action of heat on a part of the body causes a burn which results in destruction of the tissues. Burns may be caused by contact with fire, hot bodies, chemicals, electricity, etc.

Types: Burns are grouped into three classes. First degree burns are those where the heat has caused no great amount of destruction, but merely a painful redness which results in a superficial loss of the outer skin layers. Second degree burns result in blistering. Third degree burns are followed by a deep destruction and baking of the tissues.

Symptoms: Pain, redness, blisters or deeper destruction and charring of the flesh. Shock is always produced, sometimes resulting in unconsciousness.

Treatment: Burns that are slight and in which the skin is not broken are not dangerous from the standpoint of infection. The purpose of the treatment is relief of pain. Any clean ointment which relieves the discomfort, such as a thin paste of bicarbonate of soda in water, or vaseline and baking soda mixed into a paste, or carron oil, may be used. Smear the ointment over the burned area and cover with a piece of gauze.

When the burn is so deep that the skin is broken, or the flesh is injured, there is great danger of infection. Call a doctor. Meanwhile, only material which is sterile should be used. First remove the loose clothing from over the burn; but cut away and leave on the burn any parts that are stuck to the skin and hard to remove. Picric acid gauze is a very satisfactory dressing. When it is not available, use a sterile gauze soaked in five percent tannic acid solution; or gauze may be soaked in water containing one tablespoon of baking soda, or two tablespoons of Epsom Salts to a pint of water which has been boiled and cooled. These dressings must be kept moist by pouring on more sterile water until the doctor comes.

Don't apply tincture of iodine to a burn and do not use absorbent cotton on it. If the burn is severe, and especially if the patient develops a fever, it is important that a doctor be summoned without delay.

W.E. WINS ARMY-NAVY "E" ON WAR ANNIVERSARY

Exactly twenty-five years from the week Western Electric Company successfully demonstrated its first airplane-ground radio telephone, devised for the Signal Corps in World War I, the company was awarded the joint Army-Navy "E" for "exceptional performance" in connection with the present war.

NEW RESISTANCE MATERIAL FOR RHEOSTATS, POTENTIOMETERS

Rheostats and potentiometers built with improved resistive compositions have been brought out by the Clarostat Manufacturing Company of Brooklyn.

Composition-type resistors, rheostats and potentiometers are widely used in the projection room. In the new Clarostat units the resistance element consists of a core or base of bakelite, this being coated with the newly-developed resistance compound. The resistive compound, the maker says, forms a surface practically as smooth and hard as that of glass. The material is chemically treated during manufacture to eliminate all further changes in its composition, and is heat-treated to stabilize its temperature and humidity characteristics. It is claimed that tests have shown resistance values remain accurate after months of continuous usage under adverse conditions.

WAR CONSERVATION NEED STEPS UP ALTEC CONTRACTS

Increased concern with the need for conserving war materials is credited by Altec Service Corporation with stimulating exhibitors to contract for sound service and for replacement of projection room parts.

A current roundup of Altec's business activities shows service and replacement agreements recently reached with more than 50 theatres, located in 25 states.

PROJECTION FUNDAMENTALS

(*Continued from page 11*)

ing R x I = E. It's merely a matter of doing the same thing at *both* sides of the equal sign.

All of which everyone learned long ago, but many use so seldom that they tend to forget it.

The D.C. Power Formula

When one other formula is remembered along with Ohm's Law the two together become a powerful combination that can be used to unlock almost any of the secrets of any d.c. circuit. This is the simple rule that says volts x amperes equals wattage, or E x I = W. This can be transformed in the same way as Ohm's Law to show that E = W/I (by dividing both sides of the first form by I, the I's cancelling at the left) or that I = W/E (dividing both sides of the first-mentioned form by E).

The power formula and the formula for Ohm's Law can be used together, thus: since E x I = W but I x R = E, it is plain that I x R can be substituted for E in the power equation. This does not upset the equation, or require doing anything at the other side of the equal sign, because Ohm's Law tells us that E and I x R are one and the same, hence substituting one for the other does not change the truth of the equal sign at all. When that substitution is made the formula: E x I = W becomes I x R x I = W; thus the power of a d.c. circuit can be found without knowing what its voltage is. The formula

CLEVELAND MANAGERS HAVE FORM SPEECH FOR AIR RAIDS

A form speech for Cleveland theatre managers, to be read to the audience in case of a real air raid, has been distributed by the Cleveland Motion Picture Exhibitors Association. It reads:

"We have just received a U. S. air raid signal. Upon orders from the Office of Civilian Defense everyone is cautioned to remain calm and keep his seat until we receive the all-clear signal. You will not be permitted out on the sidewalks. Our program will proceed as usual. Do not worry about members of your family. They will be provided shelter by air raid wardens and police, wherever they may be. Employes of this theatre are trained in air raid precautions. We will inform you as soon as we receive the all-clear signal."

Managers are asked to keep a copy of the speech close to the stage, so they can pick it up quickly when it is needed.

SCRAP FILM, SMOKELESS POWDER NOW CONTROLLED BY WPB

Sale or other distribution of scrap film and scrap smokeless powder have been brought under control of the War Production Board by a general order covering sales of all types of soluble nitrocellulose.

$I \times R \times I = W$ is more usually written $I^2R = W$.

Again, and a fairly common case, nothing whatever may be known of a d.c. circuit except its wattage and its voltage. Using the power formula in the form $I = W/E$, the current can be ascertained, and with both current and voltage known Ohm's Law in the form $R = E/I$ will reveal the resistance of the circuit.

Sometimes only wattage and resistance may be known. In that case the power formula $I^2R = W$ will tell the rest of the story, since both R and W are known. If $I^2R = W$ then (dividing both sides by R) $I^2 = W/R$ and I itself $= \sqrt{W/R}$. That is, the square root is taken at both sides of the equal sign, the square root of I^2 being, of course, I. At the right side of the equal sign W is divided by R, and the square root of the figure thus obtained is taken, or estimated as accurately as possible. The result is equal to I, and with I and R both known Ohm's Law in the form $I \times R = E$ will give the voltage, leaving nothing unknown.

Square Root

Taking a square root is another arithmetical detail easily forgotten because it is so seldom needed. It is not necessary to recall the process here. The principle is enough. The square root of 4 is 2; of 100 is 10. To find the square root of 100 it is necessary to ask: What number, multiplied by itself, will equal 100? Obviously, 10. Then what is the square root of 125? More than 10, of course. How about 11, or 12? $11 \times 11 = 121$; $12 \times 12 = 144$; the square root of 125 is between 11 and 12. Further trial multiplications will show that 11.1 is too small, 11.2 is too large, and the square root of 125 is actually 11.18+. Any arithmetical square root can be found in the same way, by trial multiplications. Surprisingly few trials, usually not more than three or four, are needed to obtain a fair approximation; and one or two additional trials will usually give a result close enough to accuracy for any practical purpose.

Voltage Drop in Wires

In running connections to an arc lamp or to screen loudspeakers it is sometimes necessary to take into account the voltage drop in the connecting wires. If the run is long the voltage at the far end may be materially lower than the voltage at the source, unless very heavy wire is used. In planning such work it may be desirable to avoid the use of needlessly expensive heavy wire, and perhaps larger conduit to carry it, by calculating the voltage drop and increas-

(Continued on page 20)

16 MM FILMS OFFERED BY ARMY TO AID WAR PRODUCTION

The drive to increase the rate of production in war factories is now being helped by motion picture film and phonograph records as well as the conventional posters and bulletins.

The Army is now prepared to lend 16 mm sound films dealing with a large number of subjects related to war production. The Office of Emergency Management also is lending such films.

For industrial plants wired with loudspeakers and transcription turntables the Office of War Information supplies recordings ranging from a 75-second rendition of the national anthem to a 30-minute dramatization of the Victory Ship program.

PROJECTION FUNDAMENTALS

(*Continued from page* 19)

ing the voltage at the source to compensate for it. Or it may be desirable to introduce a predetermined voltage drop; always, of course, being careful not to overload the wire by giving it more current than it is rated to carry. Several formulas exist for use in such problems. One of the most convenient is:

$$\frac{D \times I \times 2100}{P \times E} = C.$$

In this formula, D is the distance between source and load (not the total length of wire used—there must be two wires to complete the circuit—but the one-way distance); I is the current, E the voltage, and P the percentage of E represented by the voltage drop in the wires; C is the cross-section area of wire needed to produce the desired voltage drop. Any wire table which gives cross-section in circular mils will then indicate which size wire to use. A table that will be adequate for most projection room purposes is reproduced here:

Circular Mills	Wire Gauge No.
1,624	18
2,583	16
4,107	14
6.530	12
10.380	10
16,510	8
26,250	6
41,740	4
66,370	2
83,690	1
105,500	0
133,100	00
167,800	000

The wire formula, like the others here given, can be manipulated according to the common rules, so that instead of finding the cross-section area in circular mils for a desired voltage drop, the formula can show the voltage drop that will be obtained if a desired size of wire is employed. For this purpose, multiply both sides of the equation by P, making it read:

$$\frac{D \times I \times 2100 \times P}{P \times E} = C \times P$$

at which the P's on the left side of the equal sign cancel out, leaving:

$$\frac{D \times I \times 2100}{E} = C \times P.$$

Next, divide both sides of the equation by C:

$$\frac{D \times I \times 2100}{E \times C} = \frac{C \times P}{C}$$

Cancelling the C's at the right side of the equation, P, or the percentage of applied voltage that represents the voltage drop in the wire is expressed by:

$$\frac{D \times I \times 2100}{E \times C} = P.$$

It is plain that any form of this equation (the form first given, for example) is all that need be remembered or noted down. Other forms of it can be derived from that one, when and as needed.

Capacitor Reactance

If all projection rooms were equipped with a.c. milliammeters, the reactance of any condenser to a.c. could be measured by applying a known voltage and frequency of a.c. to the condenser, and reading the current with the meter. By Ohm's Law the reactance would be: $X_c = E/I$. (The reactance of course changes with the frequency, decreasing as the frequency is raised.) But since few projection rooms have a.c. milliammeters, trouble-shooting that can be facilitated if the reactance of a condenser is known calls for application of a formula. $X_c = 1/6.28 \times f \times C$, where f is the frequency and C is the rated capacitance of the condenser.

Though the formula is familiar, its practical use in the projection room involves one modification, since projection room condensers are rated not in farads, as the above formula requires, but in microfarads. Allowing for this, the formula becomes: $X_c = 1{,}000{,}000/6.28 \times f \times C$. If the condenser is rated at, say, 2 microfarads, simply substitute the figure 2 for C. Then X_c at, for example, 1,000 cycles, would become 1,000,000/6.28 x 1,000 x 2, or 1,000,000/12,560 or about 79.6 ohms.

If the condenser is rated in micro-micro-farads (millionth of a millionth of a farad) write: $X_c = 1{,}000{,}000{,}000{,}000/6.28 \times f \times C$, and proceed as before.

Focal Length of Lens

$T \times A/W = L$ when T is the throw or distance from lens to screen, A the width of the projector aperture, W the width of the screen image and L the focal length of the lens. There are several other formulas, more or less similar; the one here given is simplified by an omission which results in a very slight inaccuracy. It is nevertheless widely used. It can be manipulated in the same way as the other formulas to show the width of the screen image with a given lens, rather than what lens should be used to obtain a desired width of image. For that purpose, multiply both sides by W, making the formula read $T \times A = W \times L$ and then divide both sides by L, leaving $T \times A/L = W$.

Resistors in Parallel

The formula for resistors in parallel (which is the same as the formula for condensers in series) is not an equation, and requires only the simple arithmetic of fractions. Resistors of unequal value connected in parallel come to a total resistance of:

$$\frac{1}{\frac{1}{R} + \frac{1}{R} + \frac{1}{R} \text{ etc.}}$$

in which each R represents one resistor. Thus, if the resistors have the values of 8, 6 and 4 ohms, the formula becomes:

$$\frac{1}{\frac{1}{8} + \frac{1}{6} + \frac{1}{4}}$$

These fractions are then added, in the same way any fractions are added. All three denominators will divide into 24; 1/8 is 3/24th, 1/6 is 4/24th, 1/4 is 6/24th, total: 3 + 4 + 6 or 13/24ths. The effective resistance is then:

$$\frac{1}{\frac{13}{24}}$$

which is the same as 1 x 24/13ths, or 24 divided by 13 or about 1.84 ohms.

When the formula is used for condensers in series it is handled in exactly the same way.

Committees Study Film Conservation

SUB-COMMITTEES OF the S.M.P.E. and of the Hays organization are quietly but very intensively studying plans to conserve film in the interest of the war emergency. A number of suggestions, some of them involving drastic changes in established projection practices and mechanisms, are currently under the scrutiny of engineers and of very practical-minded supervisors of projection.

Neither committee has set a definite date for publication of its findings, and at the time of going to press the discussions of both bodies are still in the confidential stage. However, I.P. can report that the general reaction to these new devices is one of considerable conservatism.

Among the methods that have had wide consideration is one developed by Earl Sponable, of Twentieth-Century Fox, which would substitute 12-tooth sprockets for the present 16-tooth sprockets in both soundhead and projector; it would change the running speed of the film from 90 to 67½ feet per minute. With smaller frames, but more of them per foot of film, the change would effect a 25 percent saving in film stock. That is, a 2,000-foot reel would run for 27 minutes instead of 22 minutes, with the same number of frames shown per minute, but each frame smaller in size. The screen would have to be masked down for a smaller picture, unless new lenses could be obtained—which is highly improbable at present; and the slower speed would involve sacrifice of sound quality unless compensation were introduced in the recording or in the projection room equipment.

Other devices and methods under consideration include one that would (it is claimed) effect a 50 percent reduction in the industry's consumption of film stock.

ALTEC PERSONNEL UNDERGOES MANY WAR CHANGES

The Government's "all-out" war program has brought about many changes in the Altec Field Personnel within the past few months. The following list is a summation of what has taken place since about June 1st:

Inspector E. A. Briggs, formerly located at Oklahoma City, Oklahoma, now is Lieut., Senior Grade, in the Navy with present address unknown.

Inspector J. R. Mather at Boston is Lieut.. Senior Grade, in the Navy and was last heard from at the Fort Trumbull Laboratories in New London, Conn.

Inspector G. P. Seagle from Newport News, Va., recently was inducted into the Army and is now assigned to the Coast Artillery School at Fort Monroe, Va.

Inspector K. A. Carmin from Dayton, Ohio, has entered the military service, but there is as yet no definite word as to which branch.

Inspector Harold Steele of New York has received his commission as Lieut., Senior Grade, in the Navy, and for the time being will be located in the New York area.

Inspector N. D. Russel of Birmingham, Ala., has been called into the Naval Service at Boston, Mass.

Inspector J. C. Gilroy of San Jose, Cal., is on leave with an assignment to the National Defense Research Council, Berkeley, Cal.

Inspector H. J. Nelson, San Francisco, Cal., has left the Company to join Radar at Red Bank, N. J.

Inspector Nick Marshall, New York, left the Company in the latter week of August to accept a position in defense work.

The many friends of Inspector B. B. Coleman, formerly headquartered at Trucksville, Pa., will be grieved to learn that he passed on at Saranac Lake, on August 11th, after quite a long illness.

Altec has welcomed into its family the following men, who will be located at points indicated: W. N. Ashbey, at Birmingham, Ala.; J. M. Brandon, at Norton, Va.; J. C. Clickner, at Indianapolis, Ind.; B. C. Ralston, at Charlotte, N. C.; A. D. Gaw, at Dallas, Texas; E. C. Holland, San Francisco, Cal.; F. E. Schaefer, at San Jose, Cal.; H. L. Lavin, at New York, N. Y.; W. A. Shaw, at Malone, N. Y.; G. C. Ornstine, Pottsville, Pa.; Finley Van Brocklin, Newport News, Va., and R. D. Barry, Los Angeles Cal.

F. J. Homsher, who was for some period of time in the Navy, has returned to civilian life and re-established headquarters in Philadelphia, Pa., where he was previously located with Altec before entering the naval service.

RCA BRINGS OUT THIRD EDITION OF PHOTOPHONE HANDBOOK

RCA has just brought out the third edition of its Photophone Handbook for Projectionists, copies of which can be obtained without charge from local RCA service engineers.

The new handbook consists of 76 pages of detailed technical data, including charts and diagrams. The foreword explains that many suggestions for conserving materials under wartime conditions have been included in the new edition.

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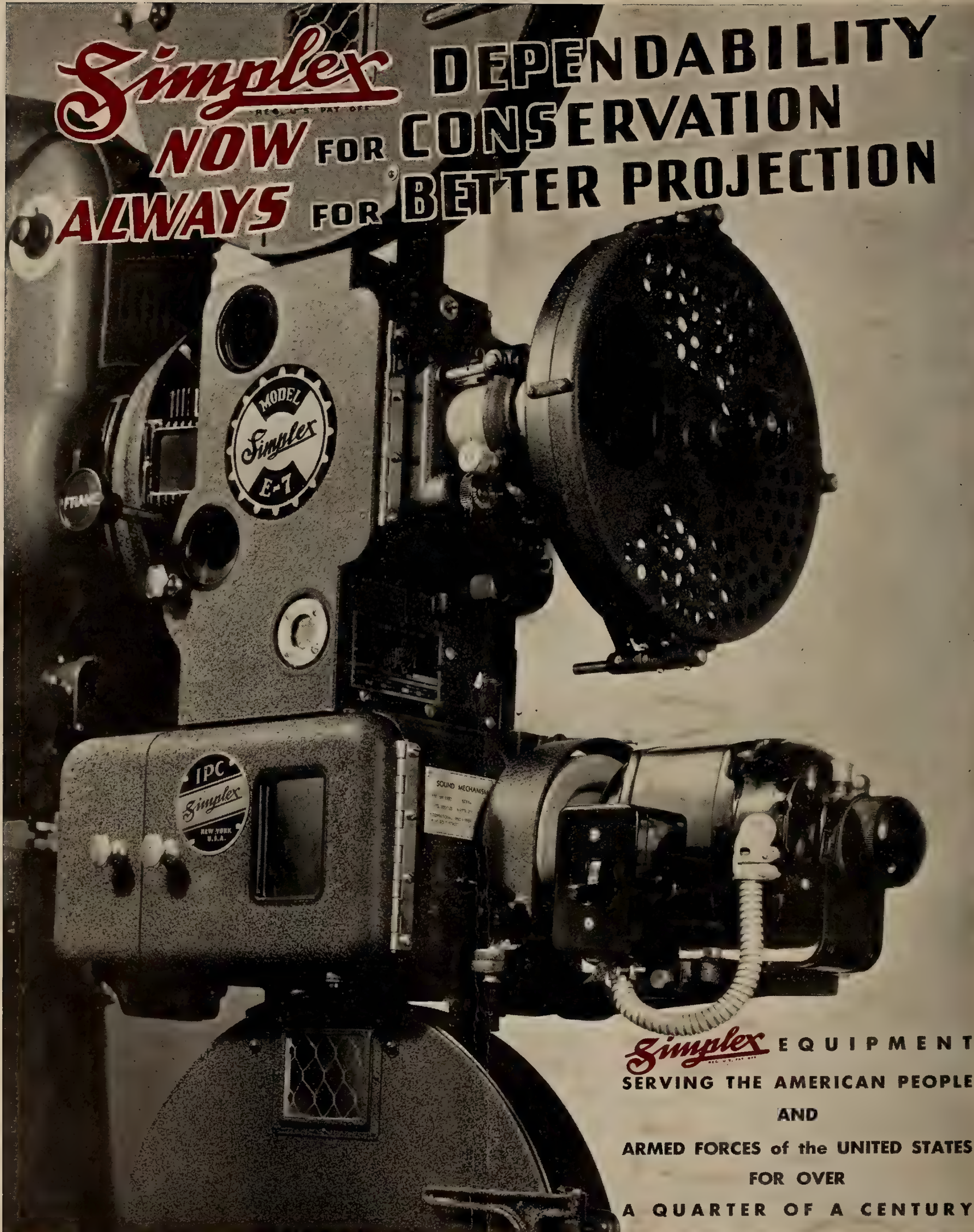
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PROJECTIONIST

OCTOBER 1942

504

VOLUME 17 • NUMBER 10

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TO PROJECTIONISTS!

Visitron cells are available for every type of sound projection equipment. Theatre supply dealers can advise the correct cell for your equipment. Buy from your supply dealer. If you wish to have your old cells tested without charge, write to G-M Laboratories, Inc., for instructions for shipping. Information furnished promptly.

SCORING VICTORIES

with Victory Carbons

The manner in which the motion picture industry has accepted and so quickly adapted itself to the use of the new Victory High Intensity projector carbons is worthy of the highest praise.

This effective cooperation on the part of theatre owners, projectionists, lamp manufacturers and distributors has shown what unified patriotic effort can do in scoring victories. A large quantity of copper has been conserved for the nation's war effort, economies have been made in power and carbon consumption and, at the same time, a general high standard of screen illumination has been preserved to the great satisfaction of the nation's vast motion picture audience.

Refer to the following table if you have not yet used the new Victory Carbons. It will help you select the proper size and type of carbons for use in your equipment.

The new Victory Carbons are identified by the "National" trade-mark imprinted in *white* instead of the familiar *blue*. Maximum allowable arc current is also stamped on each carbon. It is important that this current limitation be observed.

A complete bulletin giving details of the application of the new Victory High Intensity Carbon is available on request.

The words "National," "Suprex" and "Orotip" are trade-marks of National Carbon Company, Inc.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

Save the Copper

Most of the copper used for plating copper coated projector carbons drops to the floor of the lamp house when the carbons are burned. Continue to save these copper drippings and turn them over to an authorized scrap dealer or to such other agency as may be designated by our government.

RECOMMENDED TRIM AND RANGE OF ARC CURRENT FOR LAMPS USING COPPER COATED, HIGH INTENSITY, PROJECTOR CARBONS

Type of Arc	*Arc Current — Amperes*	*New Victory Carbons — Size and Type*
"1 Kw" High Intensity, A.C.	52-66	7 mm x 9 inch H.I., A.C. Carbons in both holders
"1 Kw" High Intensity, D.C.	40-42	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *adjustable* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *fixed* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C.	56-65	8 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by Aaron Nadell

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Monthly Chat

WE HAVE been keen to read up on as much as the public is allowed to know about wartime developments in vacuum tubes, communications equipment, arc lamps and other appliances related to projection apparatus. Apparently the public is not allowed to know very much—and of course that's as it should be. In such material as does reach print, each author generally interrupts himself, about every third sentence, to say that the details are a military secret. These interruptions occur so frequently as to give the impression that there are plenty of such details—that there's a great deal cooking. What the projectionist can do about it between now and the war's end is to brush up his acquaintance with currently available information. Then when all these surprises are sprung on us, some at least will be a little less surprising.

• • •

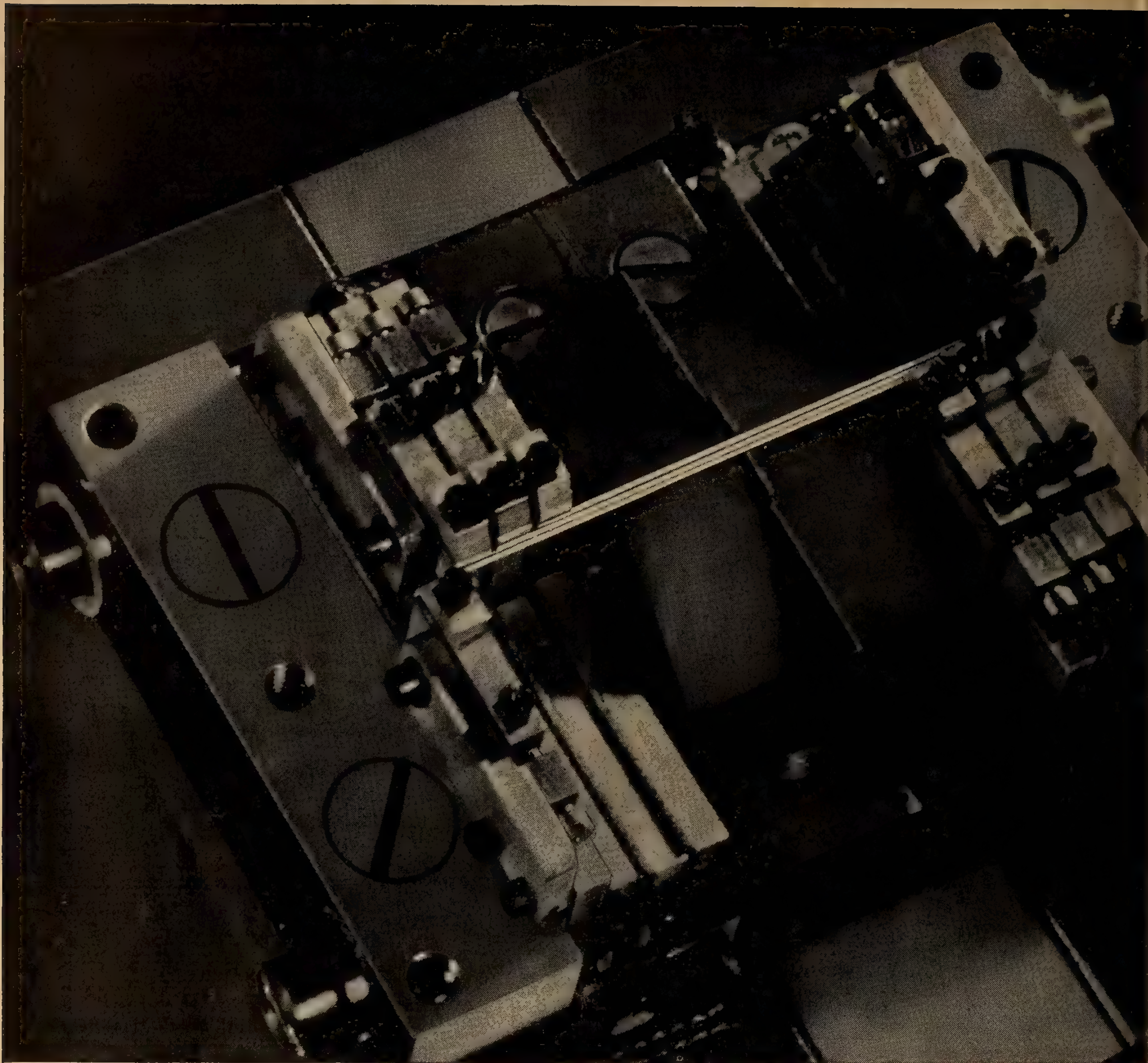
As with television, for example. For in seeing at night with television there are used, according to such scraps of published information as we have been able to find, arc lamps that give off "black light." The scene to be viewed is flooded with this radiation, which is invisible to the eye but noonday sunshine to the television camera. Some kinds of black light also pierce fog, and would cut right through the "fog" in balconies where smoking is allowed. As applied to theatre projection, that principle could eliminate the beam of light which now comes down to the screen over the heads of the audience. This military type of arc might be used to project the picture with invisible black light, which would cause a screen made of suitable materials to glow and thus present a visible image.

• • •

Well, perhaps it won't work out that way; we are very far from saying it will. The only point raised here is that these wartime developments will have unpredictable results in unexpected directions. A television improvement *may* change standard projection methods. There have been hints that the radio principle of frequency modulation might be developed to give us a new and revolutionary kind of soundtrack. We'll have plenty to learn in the early days of peace; why make the job still harder by adding in, at that time, things we might be brushing up on now?

• • •

I.P. is moving the end of this month. Beginning November 1st address your contest replies, letters, praise and beefs and renewals to 19 West 44th Street, New York City. (And don't forget the renewals.) A. N.



INTERNATIONAL PROJECTIONIST

VOLUME XVII OCTOBER 1942 NUMBER 10

Analyzing Amplifier Diagrams

By LEROY CHADBOURNE

Showing how complex diagrams of theatre amplifiers can be analyzed into a large number of simple circuits, each of which can be traced and treated individually.

IN TRACING through an amplifier diagram, such as Figure 1, it is seldom necessary in practice to go over every wire, connection and part. The work or trouble under consideration will in almost every case be related to some one portion of the whole circuit. The rest cannot be entirely neglected, because every part of Figure 1 is intimately related to every other part—what is done at one point may drastically change what happens at some other point. None the less, in practice maximum attention can be concentrated on some one part of the diagram, and the rest treated far more sketchily.

If, for example, there is some trouble definitely known by the symptoms to be in the speech circuits; or if there is some change to be made definitely known, by its nature, to be capable of influencing only the speech circuits—then there is no need to give the power circuits too much attention.

To take a practical instance, suppose some acoustical change in the auditorium or other condition makes it desirable to alter the frequency response of this amplifier. That is a matter related to speech circuits. A glance at Figure 1 shows that the tubes at the top of the drawing are all amplifier tubes; while the rectifier tube and its power transformer and associated apparatus—there is a choke coil, and condensers and resistors—all these are at the bottom of the drawing. Then for the purpose under consideration the top half of the drawing is the important half, and if the lower part is neglected that's no neglect.

To carry the particular instance in question a step further, it is fairly certain that the designers of the equipment have incorporated provisions for modifying frequency response somewhere in the system of which this amplifier is a part. If those provisions are in this amplifier, they will be found somewhere near the top among the speech equipment. And sure enough, a bit to the left of the second amplifier tube there is drawn in a .00025 mf condenser not connected to anything; and just to the left of that again another condenser of the same value, which looks as if it were connected across the speech circuit.

This left-hand condenser's circuit may be checked—the top plate is seen to be connected to the grid of the second amplifier tube; the bottom plate to the return from cathode of the same tube —that condenser is directly across the speech line, and shorting out a portion of the higher frequencies. If it were disconnected the high frequency response of the amplifier would increase. On the contrary, if it were left as it is, and the condenser just right of it, shown as not connected to anything, were added in parallel, the amplifier's high frequency response should be cut down still further.

Such changes of course may be made with the help of frequency test film and an output meter. These instruments will give an accurate indication of the effect of any change made, and the changes can be altered and various combinations tried until the desired frequency response is obtained.

There may be other provisions in this amplifier for changing frequency response, in addition to the ones just mentioned, and a glance shows that there are. Immediately to the right of the condensers mentioned there is a 65.000 ohm resistor connected across the speech line in series with either one or two .01 mf condensers. And at the extreme upper left of the drawing the input to the first grid may be coupled through either one or two .05 mf condensers. It is obvious that all these alternate arrangements were built in by the manufacturer as a means of modifying frequency response. The effect of any change made in these alternate arrangements may be estimated, calculated, measured with frequency reel and output meter, or ob-

tained from the manufacturer's instruction sheet, book or pamphlet.

Whatever may be done about the frequency adjustments, it is perfectly plain that there is no need to give much study to the *power* circuits of the amplifier in order to find the places where frequency response may be changed. Still less is it necessary to study the little amplifier at the lower right (the 336-A tube and its circuits) which is a monitor amplifier not directly associated with the main amplifier at all, although shown with it on the same drawing.

Or take an opposite case—suppose one of these tubes fails to light. Perhaps the trouble is a defective tube, but if a replacement also fails to light up tracing of some circuits is indicated. Then it is natural to begin with the power circuts—the filament or heater power circuit in fact—and ignore both the speech circuits and the plate power circuits.

Volume Adjustments

Or still a different example: suppose some change in amplification is wanted, to give a more convenient response at the volume control. Is there any gain setting in this amplifier that can be altered to bring the average sound volume required more nearly to the center of the volume control dial? If there is, it's not likely to be found among the rectifier filter equipment; it might be located in the grid circuit of one of the tubes. A glance at the first tube in this drawing shows that its grid terminates in an arrow-head at the top end of a 70,000 ohm resistor; the arrowhead of course meaning that this connection can be transferred to another point if desired.

Physical inspection of the apparatus may show that this grid connection is actually made between the 70,000 ohm resistor and the 30,000 ohm resistor just below it; in that case, bringing the connection to the top of the whole gridleak will put a greater voltage drop across the input of the tube, and result in higher gain—10 db in this case. On the other hand, if the grid is connected as shown in the drawing, dropping the arrowhead to the bottom of the 70,000 ohm resistor will effect a 10 db reduction in gain.

Many amplifiers have no such arrangement, but if there is one at all it is not likely to be found in the output stage, or in the rectifier circuit—and in looking for a provision of that kind those portions of the drawing may be wholly disregarded.

In practice, therefore, a diagram of this kind will usually be traced only in part, according to which of its circuits are more likely to contain the trouble or facility that is sought.

There are, of course, a great many different circuits, all more or less interlaced with each other. If a circuit is taken to consist of a source of power and a load, then each amplifying tube has its own plate, grid and heater circuits; three of the tubes have in addition screen grid and suppressor circuits. All these are d.c. There are also power transformer, rectifier, filter and voltage divider circuits. Added to all these, and of course partly sharing the same wires, are the speech circuits, of which each amplifier tube has two—input and output.

All these can be traced individually, but not always exclusively. They are so thoroughly interlaced, and they share each other's wires so extensively, that a trouble manifesting itself in one may have its origin in another. But it is still often possible, as has been seen, to confine attention either to one circuit or a very few; and very seldom necessary to go through every connection in the amplifier.

Some of the circuits are indeed simple and quick to trace. The power transformer primary line is one. Terminals for power input will show somewhere at the edge of the drawing. A glance around its outer boundaries shows a 115-volt a.c. input in the lower right-hand corner. This line runs through a switch to the primary of a power transformer, and that's all there is.

The most complex circuit is that of the plate secondary of the same transformer, drawn directly above the primary. This has a center tap; its two outer ends connect to the plates of the rectifier tube. In that tube the a.c. circuit becomes a d.c. circuit; one that has a large number of loads connected in parallel. These are scattered all over the drawing. It is usually most convenient to consider the plate secondary and rectifier tube, together, as forming a d.c. generator, and to look for its output terminals and bus bars. These may then be considered the power source for the multitudinous branches constituting the d.c. load. (However, every sub-branch need not be traced all the way back to the bus bars, but only as far as a minor distributing point).

"Generator" Circuit

At any moment when the right-hand plate of the rectifier tube is positive, the right-hand half of the secondary of the power transformer will be "working"; and since the left-hand plate of the tube is negative at that moment, the left-hand portion of the transformer secondary will not be "working". It will be out of action—open-circuited within the tube. Only one-half of that secondary will be working at a given moment; and whichever half it is, the centerpoint will be the most negative part of the circuit. The transformer centerpoint, therefore, is the negative terminal of this "generator"—more negative than the filament of the tube. The filament, although negative with respect to its plate, is hundreds of volts positive with respect to the centerpoint. So far as the external load is concerned, the filament of the rectifier tube is the positive terminal of the source of power. The bus bars can be found accordingly.

The "Bus Bars"

From the centerpoint of the transformer's plate secondary trace up a trifle, then right all the way to the ground connections; also from the centerpoint trace left all the way to the centerpoint of transformer secondary "B"; thence up a trifle and again left as far as possible. This is the negative bus bar, so to speak; though in any actual amplifier it may be only a wire, or it may be the chassis.

From the rectifier filament trace right and upward to a choke coil drawn without a core; from that coil trace left all across the drawing. This is the positive bus bar.

There must be a filter circuit across this d.c. line, to smooth out rectifier ripple. Part of the filter is the choke coil just mentioned; in addition the "bus bars" are bridged by an 8 mf condenser; and by two 8 mf condensers connected in parallel with each other and in series with 25 mfs and with 570 ohms. Further, individual power branches connecting to these bus bars are equipped with other condensers which serve entirely or in part as ripple filters for their branches.

Five principal branches are connected across these bus bars. One consists of the plate circuit of the two output tubes. From the positive bus bar, at a point just left of the choke coil, trace upward, through the output transformer to the plates of the tubes; across the tubes to their filaments, which are labelled "A". Now return to the bottom of the drawing, to power transformer secondary A, just left of the transformer core. From the centerpoint of that winding trace up to the 570-ohm resistor, left, and down to the negative bus bar.

Another load circuit can be traced from the left side of the choke coil as follows: up just a trifle, right, down, right through 4,850 ohms, up, right through the external monitor speaker, back at the upper monitor terminal and left to the plate of the 336-A tube; across that tube to its cathode, down through 405 ohms, and left and down to the negative bus.

A third load circuit can be traced from the left side of the choke coil—the positive bus bar—left to the top of a 40,000 ohm resistor, down through the three series resistors, right, and down

to the midpoint of secondary B—the negative bus bar. The three series resistors, which constitute a load upon the bus bars, also form a voltage divider that provides distribution points for sub-branches operating at various voltages.

Another voltage divider, drawn an inch to the left of the one just traced, constitutes a fourth load on the bus bars. For the fifth, trace all the way left from the choke coil to the terminal marked "plate." The rest of the load is external, and the return to the negative bus bar is through the ground terminal at the lower right of the drawing.

Subsidiary loads, drawing lesser voltages, are connected across suitable voltage drops which are produced in these main branches by inclusion of resistors of the necessary values. For example, just above power transformer windings A and B there is a 570 ohm resistor through which, as has been seen, the plate current of the output tubes returns to the negative bus. Now the positive end of this resistor is directly connected to the filaments of the output tubes, as already traced. The negative is connected to the negative bus. But the grids of those same tubes are also connected to the negative bus through their grid leaks (as will be traced in a moment) and therefore this 570 ohm resistor may be regarded as a source of voltage, for which the grids and filaments of the power tubes constitute the load terminals (no actual current flows). Here is a complete circuit of its own. A subsidiary circuit, ultimately deriving its voltage from the main power source, but complete in itself with a voltage source and a pair of load terminals.

Return for a moment to the ground terminal at the lower right of the drawing and trace left about an inch and a half, up to the second connection point, thence left and up again to a line running left all the rest of the way across the drawing. This line is an extension of the negative bus bar. The grids of the two power tubes return to it through their grid leak resistors.

The reader would perhaps prefer to trace the rest of the power circuits for himself, remembering that in each branch there is a power or voltage source of some kind, which he may regard as a generator so far as that branch is concerned; and there is a load of some kind, though it may be no more than the "open switch" provided by the grid and cathode of a tube.

A Plate Power Line

Start with any load; ascertain its terminals. For example, the plate power circuit of the first amplifier tube. The load terminals of that circuit are the plate and cathode of that tube. The cathode returns to the upper extension of the negative bus, through a 5,500 ohm resistor which is thus in series with the load. The plate returns through 100,033 ohms (the 33 ohms are the meter resistor) to a point on a voltage divider, a point separated from the negative bus by 170,000 ohms. The positive and negative ends of that 170,000 ohms of resistance constitute the (subsidiary) power supply terminals of the plate circuit in question.

Speech circuits can be traced in a very similar way, and are far less complex than the plate power arrangements, though it is necessary to remember that speech current is a.c., and therefore a condenser in a speech circuit does not constitute an open switch.

In considering a.c., phase also has to be considered. The 310-B tube about the center of the drawing is a phase inverter, supplying the lower of the two power tubes. Because the speech current goes through one more stage of amplification in reaching the lower 300A tube than in reaching the upper 300A tube, the speech current in those two output tubes is 180 degrees out of phase, or push-pull.

The arrangement avoids use of a push-pull input transformer for the power tubes. Volume in the two power tubes is kept the same, in spite of the additional amplification to one of them, by introduction of suitable losses in the phase inverter circuit. The inverter tube, it will be noted, is connected primarily as a triode, not as a pentode; the screen and suppressor grids, tied together, serve as the plate.

In tracing the speech circuits, the 100,000 ohm grid leak of the first tube may be regarded as the load connected across

(*Continued on page 18*)

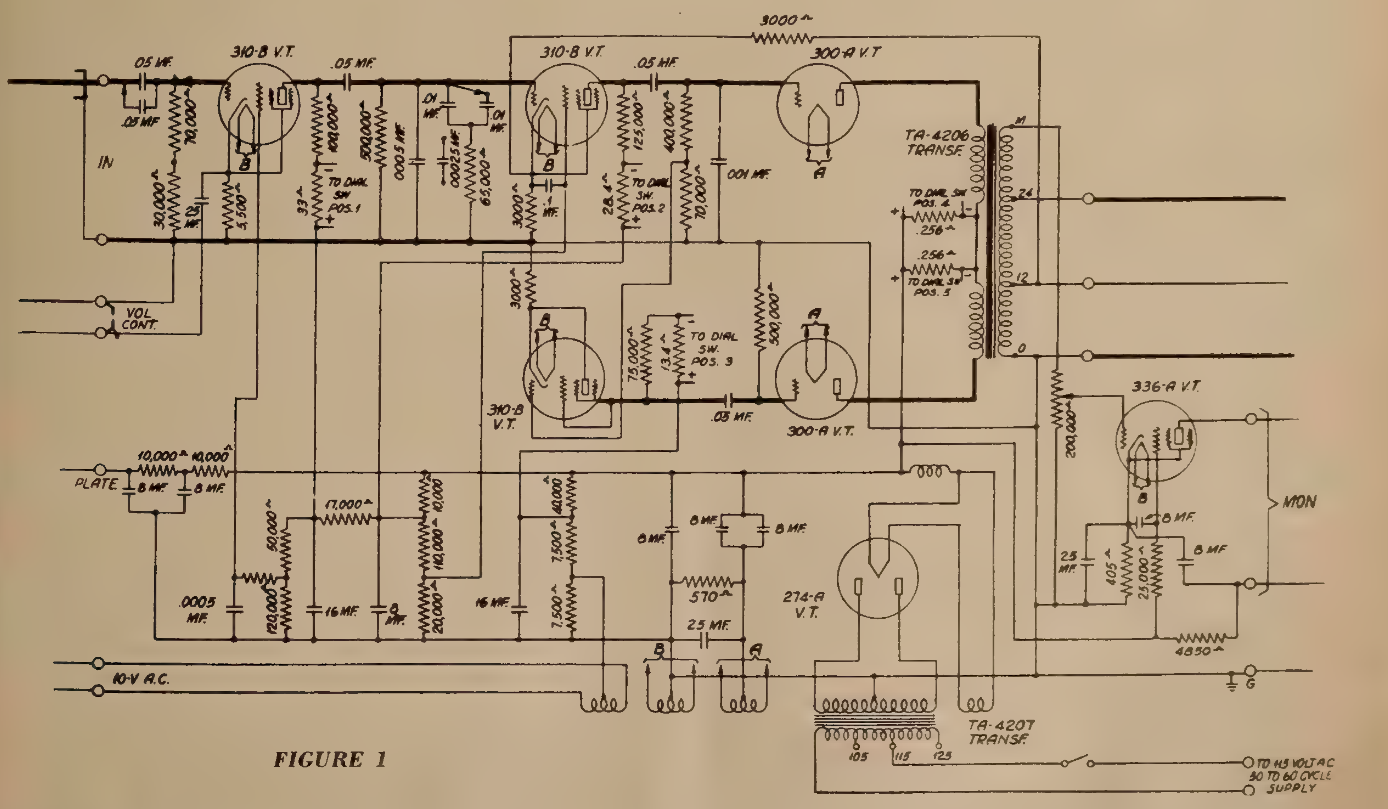


FIGURE 1

Maintaining Projection Standards In War Time

By *LESTER B. ISAAC*

DIRECTOR OF SOUND AND VISUAL PROJECTION, LOEW'S THEATRES

The Loew Theatres' system of projection room maintenance is here described in detail. Use of similar systems by all theatres, even the smallest, will assist materially in maintaining projection standards under war-time conditions, the author believes. His paper, which Mr. Isaacs read before the September 17th meeting of the Atlantic Coast Section of the Society of Motion Picture Engineers, is here presented in somewhat condensed form.

IN presenting this paper, "Maintaining Projection Standards in War Time," no attempt will be made to establish hard and fast rules and regulations for the motion picture industry. I am, however, hopeful that the systems, methods and ideas developed by Loew's Theatres, which have proved of definite practical value over a long period, will also be helpful to others.

The high standards which have been achieved in both visual and sound projection should be maintained even in the face of a shortage of replacement parts. Ingenuity, effort and experience can accomplish a great deal if the will is there.

Again—we are at war. Defect may cause the audience to become uneasy. The motion picture is a tremendously important medium for upholding morale.

Peacetime Methods Insufficient

Peacetime procedure is not sufficient under present conditions and we hope that theatre owners and managers will take increased interest in projection and projectionists. Much can be accomplished by collective effort and co-operation. This is not the time for criticism of either personnel or equipment. If the equipment is out of order, the owner will be out of luck, and the projectionist out of a job because it is found necessary to close down.

It is no longer possible to expect prompt service from supply houses. They have done a remarkably good job in the past, but this is over for the present. Manufacturers will be unable to supply new equipment or parts.

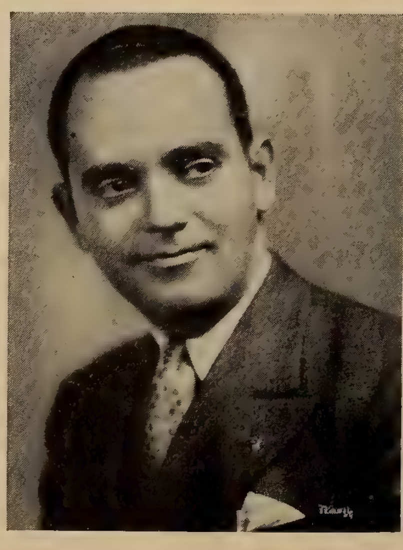
American initiative and self-reliance in the pioneer days of motion pictures played an outstanding part in building up the motion picture industry and will not fail us now. System and organization will of course supplement the ability and effort of the individual. There must be no undue or unnecessary lowering of the projection standards it has taken 40 years to establish.

The report of the projection practice sub-committee of the Society of Motion Picture Engineers Theatre Engineering Committee, in collaboration with the I.A.T.S.E. and M.P.M.O., giving in detail the 10 point program co-operating with the Government National Conservation Program, had a far reaching effect. It was a splendid job and well deserved the attention it attracted.

One of the outstanding developments of the past year has been the appointment of educational committees by I. A. Local unions throughout the United States and Canada. The purpose of these committees is to discuss technical problems of projectionists, to make ready for emergencies, and most of all to prevent the closing down of theatres due to defective projection equipment.

Theatre owners and managers will find it greatly to their advantage to take an interest in the proceedings of technical organizations in this field. Any support given to the educational activities of I. A. locals will prove highly profitable in many ways. Methods must be found to secure full co-operation. Theatre owners and projectionists now more than ever have interests in common. The current meaning of "the show must go on" is that equipment should be kept in order at all times and no effort spared to keep theatres open if it is in the power of projectionists and technical men to prevent their closing.

Loew's theatres has always endeavored to give projectionists full encouragement in their efforts to improve projection. A recent activity now in successful operation is the issuance of a limited number of certificates of merit presented to Loew's projection room staffs who indicate exceptional interest in their work. These certificates of merit are tangible evidence of the efforts Loew's has made for many years to raise projection standards. We believe something similar to this, at least in spirit, will be found of practical value by all theatre owners.



Lester B. Isaac

We now submit for your consideration Loew's control system which has been developed by us in the past 16 years. We believe that this system can be readily adopted by small chains and its fundamentals will be found useful by even the most moderate sized single theatre. It is true it may take a little while to get the system in practical operation, but it should prove of invaluable assistance in preventing neglect at any time, and particularly helpful in avoiding serious consequences during the war period.

Loew's Control System

1. A questionnaire form which gives a complete history covering the date the theatre opened, type, serial numbers of all equipment as contained in the projection room; together with the size of all wires, conduits and fuses, and a complete inventory of all supplies and spares.

2. A complete record of all supplies as to type, quantity and date received.

3. A repair record showing the exact date each piece of equipment was repaired and the cost of same.

4. Projectionists' film reports. This form is used in order that we may have a record as to the condition of the film when received at the theatre. It also serves to indicate the condition of the projectors in case of damage to the film during its run in any particular theatre, and prevents carelessness and unnecessary damage of film.

5. Carbon consumption form. A weekly report which also shows whether or not the illumination system is performing correctly. These reports are averaged over a certain number of weeks and if the equipment is functioning correctly and the proper current is being used,

the total average will indicate right consumption.

6. Monthly report of projectionists. This report covers a complete inspection of all equipment and the projectionists' opinion as to its condition. These reports are carefully checked by our department and any indication of defect is immediately corrected.

7. Bulletin form. We issue at required intervals a bulletin to all theatres containing information on the elimination of trouble with certain elements of the equipment, or recommending additional adjustment which we have found improved the functioning of the equipment. This form is also used to advise the projectionists in advance of any new equipment that their theatre is scheduled to receive, or any changes in supplies, such as carbons, etc., giving all details as to the handling of same.

Through Loew's control system together with other records that we maintain in our office we have on hand a complete history of each and every unit of equipment covering its complete physical condition at all times. The control system is the foundation of proper maintenance of projection standards in war time as well as under normal conditions.

Loew's Replacement Policy

Prior to 1940 it was the policy of Loew's to repair projection mechanisms once a year and lamps once every two years. The program permitted projectionists to secure the best possible screen presentation and at the same time kept film damage at a minimum.

We adhered to this policy for many years but ultimately came to the conclusion that after a reasonable period of use, continued expense for repairs was merely buying old equipment on the installment plan. Late in 1939 we made a survey of equipment in Loew's theatres and as a result set up a program for the replacement of projector mechanisms and arc lamps. Prior to this we had made experiments and when we were satisfied that the equipment we had been testing met all our requirements, orders were placed. Now a large number of our theatres are in a much better position to maintain projection standards for the duration. On some kinds of equipment we are, however, no better off. We must continue to practice extreme care in order to avoid troubles caused by present shortages. Such a situation is particularly disturbing to us as have always taken great pride in the high quality of Loew's projection.

It is possible that others may feel that our standards are too high but they have proved very practical and highly profitable. It is a great satisfaction to us to know that we have not had a single fire due to faulty equipment. Film mutilation is practically nil in our theatres and we are definitely proud of the results on the screens of Loew's Theatres.

It is possible that many will believe that the things we have done are due to the size of our organization, great facilities and vast expenditures, but this is an error. Each Loew's Theatre must pay its way through the revenue received from its own box office.

The cost of unnecessary damage to film and the lack of wisdom in continuing to repair old equipment are thoughts which should receive the attention of the motion picture industry when we return to normal conditions. Likewise the advantages of a third projector, or an extra mechanism, intermittent movement and spare parts will receive more attention in the future than they have in the past.

Facts and Figures On Carbon Conservation

THAT carbon savers reduce waste by as much as 26 percent has been proved by the projection crew of the Paramount Theatre, New York, where careful check has been kept for some time on average stub lengths and burning rates both with and without carbon savers. Their figures, summarized below, offer striking evidence of the results that these devices can produce.

The Paramount crew were impelled to work out detailed figures largely because of the need for war-time conservation. Their negatives are copper-coated; but aside from that, they declare that conserving even carbon itself will permit allocating a larger proportion of overtaxed manufacturing facilities for war purposes. In addition there is, of course, a direct economy to the theatre.

The accompanying photograph illustrates the difference in lengths of carbon stubs for the Paramount's trim of 13.6 mm x 22″ positives and 7/16″ x 9″ copper-coated negatives, with and without the carbon saving device. The 6″ positive carbon stub nearest the ruler indicates the average length of carbon discarded when the saver is not in use. The next carbon is the 2″ positive stub which remains when the carbon saver is used on the positive carbon. The third carbon is the average 3½″ negative stub when no carbon saver is used and the fourth carbon is the 1¼″ negative stub remaining when the negative carbon saver is used.

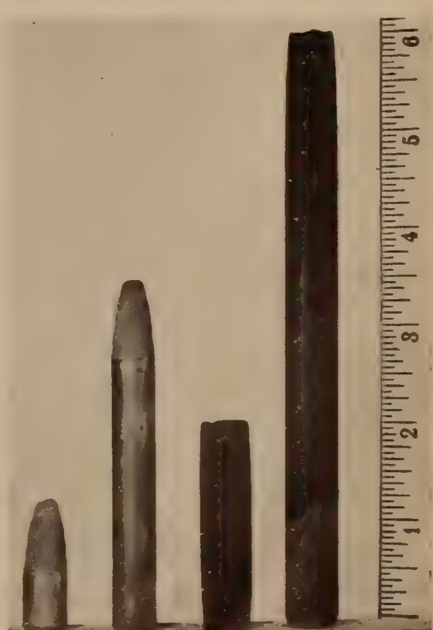
Since a new 13.6 mm carbon is 22 inches long these figures mean that only 16 inches of it can be burned without a carbon saver, but 20 inches can be burned with one. In the first instance 73 percent of the positive carbon is used. With the saver it is possible to use 91 percent. The positive carbon is consumed at the rate of 4 minutes per inch. This translated into burning time means that the positive carbon will burn 64 minutes without the saver and 16 additional minutes (a total of 80 minutes in all) with the saver.

The positive carbons cost approximately 25 cents each; and the 18 percent saving that can be effected amounts to the same as a reduction of 4½ cents on the price of each carbon.

The percentage of saving in the negative carbon is even greater. A new negative is 9 inches long. Without a carbon saver only 5½ inches, or about 60 percent, can be used. With a carbon saver it is possible to use all but 1¼ inches of the negative, that is, 86 percent of the carbon. The difference in these percentages indicates that a 26 per cent waste of negative carbon is salvaged by the carbon saver.

The negative carbon is consumed at the rate of 21 minutes per inch. In terms of burning time, the negative would last 115.5 minutes without the saver and 47¼ additional minutes if the saver were used, making a total of 162¾ minutes.

The cost of each negative carbon is approximately 9 cents and while the actual monetary saving is not as large as in the case of the positive (being approximately 2¼ cents on each carbon) it is actually larger proportionately. And the Paramount crew point to the particular importance of burning the negative as short as possible in order to conserve the use of copper.



Comparative lengths of carbon stubs.

In The

SPOTLIGHT

By HARRY SHERMAN

THERE would be little need to worry about the post-war period if every army post handled projection in the same way as the recently opened Signal Corps Photographic Center at Astoria, Long Island. This center, occupying the former Paramount studios, the largest in the East, is making instructional pictures for all branches of the service. Its projection and sound department is under the command of Captain Misener, member of Ann Arbor, Michigan, Local No. 395. The chief projectionist is the veteran Cecil R. Wood, Sr., who was chief projectionist for "The Birth of a Nation" many years ago, and for "Fantasia" very recently. The eight civilian projectionists are all members of New York City Local No. 306; the one soldier projectionist, who is an I. A. application man, is Private Charles Beckman, Jr., son of Charles Beckman, Sr., financial secretary of Local 306. The eight civilians are paid from $2,900 to $3,200 yearly, and although this is not quite in line with the union scale for the district, it is understood that increases have been requested by the officers in charge and will be forthcoming as soon as an allowance can be obtained from the War Department.

● Hobart Burns, member of Lewiston, Idaho, Local 663, has been elected President of the Idaho State Federation of Labor, which makes Burns one of the charmed circle of labor leaders who are members of the I. A. This is a very high honor to be conferred on one of our members. We trust Burns will have a very successful administration.

● L. G. DeNayer, business agent of Local 240, Billings, Mont., has recently returned home from the Mayo Clinic, Rochester, Minn. DeNayer entered the clinic immediately after the Columbus convention, and remained there under strict observation for ten weeks. Now that he is home again and full of pep, we hope, we would like him to contact this department with some good news about himself and his local members.

● A new double-scraper has been put on the market which is supposed to make and secure a patch properly. This attachment, which can be used only for the Griswold splicer, enables the projectionist to scrape the film on both the emulsion and celluloid sides with one operation. For further information regarding this device, get in touch with the inventor, Max Munch, member of Local 306. You may contact him at his home address, 200 West 72nd Street, New York City.

● Seems like the boys of Detroit Local 199 are going in for farm buying these days. Why not? If the food prices continue rising, these boys will be able to tell all food dealers to take a jump in the lake.

● Earl Hartman, president and business agent of Local 388, Youngstown, Ohio, has been elected a member of the executive board of the Ohio State Projectionists Association.

● In addition to his many duties as business agent for St. Louis Local 143, Bob Tomsen has presided at meetings of the film workers, recruited many labor leaders in the board drive, and was largely responsible for the sale of war bonds totalling $660,000. That's great, but now that it is over and the industry is over the top in its billion dollar war bond drive, we wonder how many boys on our side of the fence will get credit or publicity.

● For having brought honor and distinction to Local 4, Brooklyn, New York, one of the oldest locals in the I. A., Richard Walsh, president of the I. A. T. S. E. and also president of Local 4, will be tendered a testimonial dinner by the membership at the Hotel St. George in Brooklyn on October 29. Full details of the dinner will appear in our next (November) issue. We'll be at the party, too.

● The November issue of I. P. will come out shortly after election day, hence this tip to all I. A. locals throughout the country. Advise your members not to vote for any candidate for office whose record shows opposition to organized labor. Your voting power is your strongest weapon. Vote only for those candidates who have the interests of labor at heart, and kick the others in the pants. This reminds me of the "appreciation" shown by the new mayor of Atlanta, Georgia, who insisted upon appointing a NON-UNION projectionist on the board of examiners despite the strong protests of Atlanta Local 225. Let's hope the boys won't forget this insult when the next election rolls around. You'll get nowhere if you permit these politicians to bowl you over—if there is any bowling over to be done you do it first.

● We have a booster in J. W. Simeral, secretary of Local 613, Salem, Ore., who reports that the motion picture projection machines at Camp Adair are being run by soldiers who knew nothing at all about the art of projection before entering the service. These soldier projectionists receive $11 per week extra pay. In discussing this matter with Captain Wimer of that post, he learned that the army was training many men in the service for this sort of work. Simeral further says, "Captain Wimer told me that in the event an operator enters the armed forces, he should get in touch with the post service officer and state his qualifications. He will then have an excellent chance to get in one of the post theatres as a projectionist. Personally, I think that it is the duty of every man who is a member of our craft to make an effort to get one of these post theatre jobs when he enters the service. He will not only protect himself when he returns to civilian life, but he will also protect the livelihood of his fellow members." This is in line with what we have been harping on for the past few months, and we hope it sinks in good and plenty.

● Figures compiled from box office receipts reported by distributors and circuits from every section of the country clearly indicate that the gross income for the Labor Day week-end broke every record by a wide margin. In some quarters the average increase over a regular week-end was reported to exceed 30%. Did any projectionist in any part of the country get as much as a dinner out of it?

● F. R. Reardon, business agent of Alliance, Ohio, Local No. 189, reports that he has signed a two-year contract for his members calling for a salary increase of 10% for the first year, and another boost for the second year. The agree-

ment was made with Ray Wallace of the Tri Theatres, for the Morrison, Strand, Mt. Union, and Columbia Theatres. Evidently Reardon is not asleep at the switch.

● Local B-51, New York Exchange Workers (I.A.) has renewed its contract for the next two years. Lou Johnson, the president, shows great ability as a labor leader.

● Private Cecil Stein, member of Houston Local 279, is home on furlough. Cecil is attached to the Quartermaster Corps. He considers himself somewhat of a pool shark, and has challenged the writer to many a game. Good luck, Cecil, and next time I get to Houston I will swap the pool challenge for a fish dinner. Okay?

● Newark, N. J., Local No. 244 is asking for a 25% increase in salary. Meetings have been held with the exhibitors, and at this writing negotiations have not yet been completed. We will report the results of these negotiations as soon as we hear of them. Local 244 is under the able leadership of Louis Kaufman and Harry Oppenheimer.

● Hats off to the officers of the I.A. Photographers Union Local No. 644. All cameramen in the eastern part of the country are now under their jurisdiction. They have the newsreel cameramen (commercial and documentary) as well as production men under their wing. That's going some! Walter A. Lang is the business agent, and a live wire at that.

● Ye editor is attempting to focus the spotlight on the many important men who are members of the Alliance—men who are important in their own localities. Many I.A. men are leaders in the various Trades and Labor Councils, and many more take active part in local and national politics. We should like to write about these men, and we would appreciate it very much if locals would advise us of any member who might fit into this picture. Thanks.

● Another of my monthly suggestions: To promote patriotism in our locals, why not have the officers open the meetings with the pledge of allegiance? We have been reliably informed that Floyd Billingsley, 3rd vice-president of the I.A., did that while presiding at the Second District Convention in Columbus last June. Try it at the regular or special meetings and get your members' reactions to the idea. We are in favor of it, and believe that Billingsley deserves much credit for it.

● We understand that Charlie Dentelbeck, supervisor of projection for the Famous Players Canadian Circuit, has extended an invitation to the S.M.P.E. to hold its next convention in Toronto. We are in favor of this plan and will do whatever we can to help him put it over, provided the war effort permits.

● After long and tiresome negotiations, a 3-year contract was signed between the exhibitors of Minneapolis and the projectionists Local No. 219. This contract calls for a 5% increase, retroactive from May 1942 to November 1942; an additional 2½% increase for the second year; and a further 2½% increase for the third year. Strike notice had been served on the exhibitors, and for a while it looked like shuttered theatres. Local 219 finally won out, obtaining practically everything asked for in the first place. Good work, Yutzy, and the rest of the committee!

● A novel scheme for the purchase of war bonds has been evolved by Local 120, Pittston, Penna. A $250 war bond is purchased in the name of the local whenever a member joins the armed forces. Up to the present time, Local Union 120 has four stars in its service flag and four $250 war bonds. Other local unions may wish to follow suit.

● James Whitebone, president and business agent of St. Johns, N. B., Local No. 440, is also president of the New Brunswick Federation of Labor and was a delegate to the convention of the Trades and Labor Congress of Canada recently held in Winnipeg. In addition to his political activities, Jim is employed at the Capitol Theatre as projectionist—and, they tell me, he is a mighty good one.

● Local B-43, film workers of Albany, N. Y., comprising six exchanges, is the newest addition to the great I.A. family. This is just a beginning, for all front office workers are scheduled to receive their charters in due time. Welcome to the fold.

● President William Green, of the A. F. of L., is very "hopeful of concrete results this winter" in the proposed merger with the C.I.O. "*Preliminary exploration will be necessary in the early stages,*" he declared. "*There is much ground to cover, but our committee is ready for a sincere endeavor to bring the two great houses of labor together.*" With that combination, the labor movement in this country should be the greatest ever. Canada will also benefit from such a combination, and if it were possible to wipe out that rump projectionist union there, the Canadian membership would be that much better off.

● We bow to the patriotism of the membership of the Motion Picture Laboratory Technicians Local No. 702 (I.A.), New York City. Two hundred members of this great organization will donate as many pints of blood to the Red Cross the latter part of this month. How does that compare with those who give only when ordered to do so? Furthermore, John Rugge, president of Local 702, recently staged two rallies for the sale of war bonds. The I.A. membership throughout the country is giving blood, money, time, energy and skill for the war effort.

● The bond of friendship existing in the industry today between the service man and the projectionist may be attributed in a large part to the desire of the Altec Service Corporation officials to cooperate with the projectionists in the conservation of projection room equipment. The projectionist is urged to conserve every bit of material, and the service man is always ready to cooperate with him.

● Fred Closser, Local 253, Rochester, N. Y., seems to be pretty fast on the trigger. The Webster Theatre, where he is employed as projectionist, is quite a distance from his home, and when gas was rationed he immediately shelved his car and got himself a bicycle. He must possess a mighty powerful pair of legs to manipulate his new gadget, and deserves mention for his share in the saving of gas.

● Every organization is proud of its members serving with Uncle Sam's armed forces. A great many of them display service flags with stars denoting the number of men in the service. Wouldn't it be a fine gesture if the I.A. emblem were also to be shown on the banner? Come on, boys, let us have your ideas on this.

● It was with deep, justifiable pride that I.A. Secretary-Treasurer Lou Krouse announced recently that his son, Ted, had been accepted as a cadet at Annapolis. Lou is mighty proud of that boy and of the signal honor he has brought to the Krouse family. Good luck, Teddy, I knew you when you were a babe in your mother's arms.

● Several years ago, during the depression, the Chicago Stage Hands Local No. 2 gave the exhibitors in that city a 20% cut, with the promise that it would be returned as soon as business picked up. Up to the present time only 15% of this cut has been returned to the members and they are now asking for the remaining 5%. When they do get this 5% they will be just where they were several years ago. Many other local unions are in the same boat—

(*Continued on page* 19)

Thank You, Tenth District!

TENTH DISTRICT
OF THE
INTERNATIONAL ALLIANCE *of* THEATRICAL STAGE EMPLOYEES
AND MOVING PICTURE MACHINE OPERATORS
OF THE
UNITED STATES and CANADA

GLENN H. HUMPHREY, *Secretary* 1021 King Street Phones 2-0485—4-7927
UTICA, N. Y.

Comprising the following affiliated organizations of the State of New York.

Stage Employees

New York City	No. 1
Brooklyn	No. 4
Syracuse	No. 9
Buffalo	No. 10
Albany	No. 14
Rochester	No. 25
Troy	No. 29
Binghamton	No. 54
Utica	No. 128
Schenectady	No. 139
Nassau & Suffolk Co's.	No. 340
Westchester Co.	No. 366

Projectionists

Buffalo	No. 233
Rochester	No. 253
Troy	No. 285
New York City	No. 306
Schenectady	No. 314
Albany	No. 324
Utica	No. 337
Syracuse	No. 376
Binghamton	No. 396
Nassau & Suffolk Co's.	No. 640
Westchester Co.	No. 650

Stage and Projectionists

Newburg	No. 45
Geneva	No. 108
Auburn	No. 119
Niagara Falls	No. 121
Jamestown	No. 266
Cortland	No. 272
Elmira	No. 289
Gloversville	No. 290
Dunkirk	No. 308
Middletown	No. 311
Amsterdam	No. 313
Lockport	No. 318
Watertown	No. 338
Port Jervis	No. 353
Ithaca	No. 377
Rome-Oneida	No. 474
Corning	No. 480
Olean	No. 484
Poughkeepsie	No. 499
Glens Falls	No. 524
Oswego	No. 532
Johnstown	No. 535
Batavia	No. 581
Saratoga Springs	No. 592
Little Falls	No. 609
Kingston	No. 637
Rockland Co.	No. 645
Hornell	No. 676
Malone	No. 749

Cinematographers

New York City	No. 644

Studio Mechanics

New York City	No. 52

Laboratory Technicians

New York City	No. 702

Treasurers

New York City	No. 751

September 1, 1942

International Projectionist
New York, N. Y.

Gentlemen:

At the Tenth District Convention held in Rochester, August 16th, 1942, the delegates assembled went unanimously on record endorsing your publication and recommending that local unions subscribe for their entire membership.

In the discussion at the convention preceding this action, it was brought out that its splendid technical articles are a necessary adjunct to any local union's educational program, and that the present aggressive editorial policy is assurance to the projectionist that he has a publication that will defend his interests in the motion picture field.

With best wishes for continued success for your publication, I am

Yours very truly,

Glenn H. Humphrey

Glenn H. Humphrey,
Secretary-Treasurer,
District #10,
I.A.T.S.E. & M.P.M.O.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

WRAP wire to be marked with clear scotch tape, then lay slip with identifying information on top of tape and take one turn to cover slip. Marking is protected from dirt and dust and wiring not cluttered up as by use of tags.—J. D. STEELY, *RCA, Pittsburgh.*

• • •

A recent call from one of my theatres late in the evening stated that there was no sound in either machine and that the theatre had been closed and the refunds made.

Upon my arrival at the theatre, I found that such was the case, and an investigation as to the cause of this trouble disclosed the fact that the photoelectric cell voltage on No. 1 machine was only 2 volts, and on No. 2 machine was only 10 volts.

Inasmuch as this condition indicated something very unusual, a further check was made and it was found that this trouble was due to a ground in the duplex lead cable carrying 90 volts from the 714-A apparatus unit to the 49 type amplifier.

This short was due to the deterioration of the rubber installation which had allowed the bare wire carrying the 90 volts to come in contact with the lead shield.—LOUIS J. KRAFT, *ALTEC, Columbus, Ohio.*

• • •

Removal and replacement of connections on terminals, where soldered, can be done quickly and neatly if the excess solder is first heated to melting point and brushed off with a tooth-brush. A clean terminal results. (Careful of eyes.)

Some booths do not have plug receptacles installed. When test equipment, soldering irons, etc., have to be used they can be plugged into a female plug, which I carry, the leads of which are attached to spring test clips. Open switches or other line terminals can always be located for hooking on.—R. H. BISBEE, *RCA, New York.*

• • •

A recent call reported feed back noise at times causing a loud screech. I tested all tubes, checked amplifiers, removed all wiring between amplifiers and installed new wire. I tightened all conduit joints and installed new ground wire and clamp and thought that these efforts had apparently cleared the trouble.

However, on the next day a further call from the theatre indicated that this feed back noise had occurred again even worse than before. I again tried to get this noise to show up from 5 to 10 P. M. and finally it started in the last reel of the show. (But here's the pay-off and it is good for Ripley). This screeching noise is primarily mechanical and is loudest in booth, although it goes through the system very loudly and blocks out speech, with a frequency of about 4,000 cycles. I found that touching the hand wheel on the projector motor would stop the noise. The trouble was due to the hand wheel being moved on the shaft. Tightening the screw corrected the trouble. Don't ask me how the feed back got in the system but I suppose the vibrations being so strong set some of the tube elements to vibrating.—L. W. MCCLUNG, *ALTEC, Albany, Ga.*

• • •

During shipping and handling the mercury in the stock No. 29225 Rectigon tubes splashes about, sometimes leaving an accumulation on the elements and element supports. The filament will sometimes retain enough mercury to actually fill coils of the winding and effectively approach a shorted condition. Likewise a layer of mercury on element supports will cause some tubes to show continuity, varying from dead short to high resistance, between the filament and plate.

Thus all tubes should be carefully examined before installation and any appreciable accumulation of mercury particularly in the filament coils should be shaken loose by gently tapping the tube. The film of mercury which remains on the filament will be quickly vaporized when filament voltage is applied, without blowing regular fuses.

In all cases when new tubes are installed the filament should be preheated several minutes before plate voltage is applied. If a continuity check showed a short between the plate and filament before installation, another check should be made after the filament has been preheated. If the short is still present the tube should be discarded, otherwise it is safe to apply load to the tube.

The units should be allowed to operate under full load until all circuit elements have reached normal operating temperature before final adjustment of exciter lamps voltage is made.—P. C. HUMPHREY, *RCA, Boston.*

• • •

In the event that the oil collector jar needs replacing on a Western Electric Universal Base, a large Alka-Seltzer jar serves as a perfect replacement.—A. C. HOLLAND, *RCA, Dallas, Texas.*

• • •

A projectionist in one of my theatres complained loud and long because the volume controls of his Simplex A system are not interconnected. I helped him belt the two knobs together using a good grade of fish line. Two wraps were put on each knob of the AM-101 amplifiers and a weak spring inserted in the belt to maintain a slight tension and to take up stretch of the line. It sounds haywire but got the job done, and it does not slip.—W. R. OPFEL, *ALTEC, Albuquerque, N. M.*

• • •

Projectionists should be cautioned to examine, before inserting in amplifier sockets, the guide pin on 1622 metal tubes and other tubes of this type. A complaint was received in regard to an amplifier, which was reported to be "smoking in the rear and whistling in the speakers." Upon arrival at the theatre, it was found that the tubes had been changed and the amplifier was functioning satisfactorily. Examination of the tubes revealed one 1622 with the guide pin broken off.—P. C. HUMPHREY, *RCA, Boston.*

• • •

Where trouble is occurring from excessive heating at exciter lamp bases, it can usually be stopped by sticking a thumb tack in the lamp base before placing it in the lamp bracket. The finish on the thumb tack should be filed off first, so that the brass makes contact with the bracket.—D. M. DAVIS, *ALTEC, Lubbock, Texas.*

Wartime Uses of Motion Pictures, and 16 M.M., Highlight S.M.P.E.'s Fall Convention

THE FIRST wartime semi-annual meeting of the Society of Motion Picture Engineers since 1918 opens Tuesday morning, October 27th, at the Hotel Pennsylvania in New York City. Wartime uses of motion pictures highlight the program, yet do not entirely obscure the increasing interest in 16 mm techniques.

Directly or indirectly related to the war are scheduled papers on the Navy's use of film for training purposes; the documentary scientific and military films of the Soviet Union; the underground motion picture industry in China; the use of motion pictures in aircraft production, and the use of motion pictures for analysis of fast action.

Ten papers on 16 mm films will be presented. No other single aspect of the motion picture is receiving quite that much attention at this meeting.

Outstanding among papers dealing with 35 mm pictures will be the report of the Theatre Engineering Committee, by its chairman, Dr. Alfred N. Goldsmith. Others will deal with sound control in the theatre, sound track nomenclature, film distortions, and the effect of high gate temperatures in 35 mm projection.

The meeting will be opened Tuesday morning with an address of welcome by the Society's president, Emery Huse. The usual informal get-together luncheon for members, friends and guests will be held Tuesday noon in the roof garden of the hotel. An extensive tour of the technical facilities of Radio City Music Hall is scheduled for 2:30 P.M., Tuesday; and at 8:00 P.M. the meeting will reconvene in the Museum of Modern Art, where films selected for their importance in the development of the motion picture as a modern art form will be projected.

Wednesday's morning and afternoon sessions will again convene in the Hotel Pennsylvania; and Wednesday evening the 52nd annual banquet and dance will be held in the Georgian Room of the hotel. Thursday's morning and afternoon sessions will likewise be held at the Pennsylvania, but on Thursday evening the meeting will be convened at the Army Signal Corps' photographic center in Astoria, Long Island—the former Paramount Astoria studios. There will be a conducted tour of the center, and an exhibition of Army training films. Colonel M. E. Gillette will welcome the members.

S.M.P.E. committees directly concerned with the success of the meeting, and their chairmen, are: Reception and Local Arrangements Committee, Dr. Alfred N. Goldsmith; Registration and Information Committee, W. C. Kunzmann; Hotel and Transportation Committee, O. F. Neu; Publicity Committee, Julius Haber; Luncheon and Banquet Committee, D. E. Hyndman; Ladies Reception Committee, Mrs. D. E. Hyndman; Projection Committee, H. F. Heidegger.

Abstracts of some of the papers scheduled for the convention follow.

CARBON ARC PROJECTION OF 16 MM FILM

W. C. Kalb

National Carbon Company

This paper summarizes the characteristics of the high-intensity carbon arc as applied to the projection of 16-mm film. It includes a description of the carbon trim, color quality of the light, magnification, optical speed, and power requirements of the projection lamp. Intensity and distribution of screen light are discussed in relation to the operating characteristics of projectors commercially available and the transmission characteristics of heat filters, shutters, and available types of lenses. Resulting screen illumination is interpreted in terms of screen dimensions and audience capacity under conditions conforming to recommended projection standards.

MOTION PICTURES IN AIRCRAFT PRODUCTION

Norman Mathews

Bell Aircraft Corporation

Although the U. S. Army was producing an extensive series of training films dealing with aircraft maintenance, the Bell Aircraft Corporation believed that it, too, could help in this respect. In April of this year the motion picture division of this company was organized and production was begun on an extensive series of films, each dealing with a specific service operation. All work was to be done in 16-mm and, with the exception of the laboratory, all phases of motion picture production were handled in the division. Working closely with the service department, the details of the various operations were carefully checked for accuracy and instructional value.

Aside from being used by the Army these

Contest in Wartime Projection

A Test of Skill and Wits

KNOWLEDGE of projection, skill, and resourcefulness in meeting unusual conditions arising out of the war feature this novel contest, which is open to all practicing projectionists. Fancy writing, skill of presentation, win no prizes; prizes are awarded solely on the basis of how well the contestant has met the problem presented. The editorial staff of I.P. are the sole judges, and their decisions are final.

The following prizes are offered *each month*:

First Prize . . . . ***$10.00*** **in War Stamps**
Second and Third Prizes . . . . ***$5.00*** **in War Stamps**
Next Six Best Answers. . One Year's Paid-up Subscription to I.P.

Additionally, at the end of the contest, there will be awarded for the most consistent showing a

Grand Prize . . . . ***A $25.00*** **War Bond**

All answers must reach this office by the tenth day of the month following publication of the question: that is, all answers to October's questions, published below, must reach I.P. by November 10.

Here is the question for October:

The main drive gear on one projector has been stripped for about one-quarter of its circumference. Your theatre has no third projector; you cannot obtain a loan or rental head; because of wartime conditions you cannot get a new gear for some weeks. What do you do?

Apply this question to your own equipment, your own projection room. It's your problem, you have to solve it; there'll be no show till it's solved.

For the most ingenious and *practical* solution you win $10.00 in war stamps and a running start toward the Grand Prize $25.00 war bond.

● *SEPTEMBER'S CONTEST RESULTS will be announced in the November issue. Names of the September prize winners and some of the winning answers will be printed at that time. Meanwhile I.P. takes great pleasure in declaring that the answers have shown a high degree of ingenuity and resourcefulness, and in our opinion reflect great credit on the craft.*

films were to be used by the company's service department to train a rapidly expanding personnel and to help with service training in the field. Service representatives throughout districts in the various war-fronts were equipped with small sound projectors and complete sets of these films. A broader distribution was to be effected by the Army itself, which is placing these films in all bases where these planes are in service.

Pilot training is another subject being treated in film to tie in with the Army's recently organized safety campaign. It is planned also that soon the work of the motion picture division will be expanded to include industrial training, for which there is an urgent need today in the aircraft industry.

EFFECT OF HIGH GATE TEMPERATURES ON 35 MM PROJECTION

E. K. Carver, R. H. Talbot and H. A. Loomis
Eastman Kodak Company

In a study of the effects of high temperature arcs on 35-mm motion picture film in the projector gate, high-speed Cine Kodak pictures (1400-1500 frames per second) were taken of the image of the 35-mm film on the projection screen. In making these pictures an *E*-7 projector with a Macauley Hy-candescent lamp was used and the image was sharply focused on the projection screen. A portion of this image was used as a target for the high-speed Cine Kodak so that when this Cine Kodak picture was projected one could observe the appearance of the 35-mm image during various portions of each frame. When the high-speed 16-mm pictures were projected, it was observed that the 35-mm image was in sharp focus during only a small part of its stay on the projection screen. After the pull-down, the film comes into the gate out of focus, and slowly moves into focus. As it moves into focus it always moves toward the lamp, as if the emulsion were expanding, thus causing the film to curl away from the emulsion. In some cases it does not come into sharp focus until after the flicker blade has passed. The above phenomena occur during all normal projections but are more prominent at higher temperatures. The 35-mm projected pictures appear to be perfectly sharp, even though the high-speed analysis shows them to be out of focus during a large fraction of their stay on the screen. If the image is in focus during the last fraction of a second before the next pull-down, it appears sharp to the eye regardless of the fact that it was out of focus during the first part of its stay on the screen.

A further study of these effects was made by cutting away part of the projector gate so that a high-speed Cine Kodak can be focused directly onto the film in the gate. This study showed exactly the same effects as described above but, in some respects, made them clearer.

FILM DISTORTIONS AND THEIR EFFECT ON PROJECTION QUALITY

E. K. Carver, R. H. Talbot and H. A. Loomis
Eastman Kodak Company

The three main types of film distortion are (1) Embossing due to differential shrinkage or hardening of the emulsion caused by local absorption of heat in the dense por-
(*Continued on page* 18)

S.M.P.E. ABSTRACTS

(*Continued from page* 17)

tions of the picture; (2) Fluted edges due either to stretching of the edges or shrinkage of the center; (3) Short edges or buckle due to shrinkage of the edges while in the roll.

Careful tests have failed to show any effect on the screen, such as in- and out-of-focus effects, due to image embossing. Measurements of the magnitude of the distortions show that these are ordinarily much less than the depth of focus of the lens. Laboratory tests as well as field experience indicate that fluted edges very rarely cause distortion of the image on the screen.

Short edges, however, produce a type of buckle which often shows in- and out-of-focus. This is due to the fact that short edges leave a fullness in the center similar to the bottom of an oil can. Under some circumstances this fullness causes a movement back and forth in the projector gate causing in- and out-of-focus movement. Short edges are commonly caused by loss of moisture from the edges of the film when wound up in a roll immediately after processing. A scarcity of tin and substitution of cardboard boxes makes it desirable to dry the film more thoroughly on the processing machines so as to avoid this quick loss of moisture during the storage period before projection.

DR. JOLLIFFE NOW RCA V.P.

Dr. Charles Byron Jolliffe, former chief engineer for the FCC and more recently chief engineer of RCA laboratories and assistant to the President of RCA, has been appointed vice-president and chief engineer of RCA Manufacturing Company, with offices at Camden, N. J.

ANALYZING DIAGRAMS

(*Continued from page* 9)

the source of speech power entering this amplifier, and at the same time as the source of speech voltage in a circuit of which the grid and cathode of the first tube are the load terminals. Similarly, the plate and cathode of that tube may be regarded as the source terminals of (an amplified) speech circuit in which the 500,000 ohm coupling resistor is the principal load. And that resistor in turn may be regarded as the source of a speech circuit of which the cathode and grid of the second tube constitute the most important load. And so on. The reader may also wish to trace the rest of these details for himself.

In a way, although a vastly more complicated way, all this is a little like ordinary power wiring. If an ordinary lamp socket isn't receiving power, no one studies all the wiring between there and the power house to find the trouble. It is usually necessary to go no further than the nearest distribution point in the projection room. If the fuses and switches there do not reveal the fault then it may be necessary to go back still further, perhaps eventually as far as to the meter board in the cellar.

This comparison is very inexact, and it is not offered as a close comparison; it comes closest to holding good in connection with the branching plate circuits already described. But an amplifier contains much more than plate circuits. If the lighting circuits and the power circuits, and the telephone and the sound buzzer, all came together on the same switchboard and some borrowed their power from others, that would be more nearly like Figure 1; but there still would be just so many definite circuits, each consisting of source and load. And it would be practicable to consider each one of them separately and without reference to the others whenever it was known with certainty that the work to be done concerned that circuit alone.

And in Figure 1, if some fault should develop whereby the plate of the input tube was receiving no voltage, a voltmeter check across the two voltage divider resistors already mentioned might perhaps show that approximately normal voltage existed across them. Then they could be regarded as the source of the plate circuit of that tube—a source in good condition, with nothing left to do but to run down the rest of that circuit to find out why the power available at the source was not reaching the load. On the other hand, if those two voltage divider resistors proved to be carrying no current, they could be regarded as the load of a circuit whose source was the voltage divider immediately to the right, and so on.

Will C. Smith Passes

ONE finds it a painful task to write about the death of an intimate friend with whom one has been closely associated for over 25 years. It is difficult to become accustomed to the idea that Will C. Smith (L.U. 306) no longer is among the living. He was the very incarnation of life within a sphere of permanent, restless activity. Will was an unusually colorful figure and possessed a great personality. He had his ups and downs, like the rest of us, but he never permitted himself to become discouraged. No matter how tough the

sledding, he was always calm and unruffled. He was "Will" to the boys when he was general manager of the Nicholas Power Company, and he was "Will" to everybody when he worked as one of the crew at the Astor Theatre in New York City. He never refused to help in any emergency. Perfection on earth has never yet been attained, but Will C. Smith came closer to it than anyone we know. A staunch and loyal friend, he will be greatly missed by all of us who knew him well.

IN THE SPOTLIGHT

(*Continued from page* 13)

when the exhibitor cries "poor business" they take a cut to help tide him over the rough spots, but they have to fight like blazes to get the cut back. We suggest crying towels for these exhibitors.

● Jim McNabb, business agent of Local 154, Seattle, Wash., has signed an agreement for his members to operate 110 panoram machines in his territory at a scale of $84 per week, per man. Congratulations, Jim, for a swell job!

● Members and officers of Locals 25 and 253, under the able guidance of Mike Mungovan and Fred Boekhout, are furnishing the projection machines and stage equipment for a new USO building in Rochester, N. Y. With these boys on the job, the Rochester USO building will be one of the best hang-outs for the soldiers in the country. Good going, Rochester and a swell job.

● Local No. 170, Kansas City, Mo., has renewed its contracts for another two years, taking that out of the fire for the time being. Knowing the Local 170 officials as well as I do, there can be no doubt but that they took very good care of their membership's welfare.

● Do you know what happens to your money when you buy war bonds? Here is the story. Out of each hundred dollars Uncle Sam gets, he spends $23 for airplanes, $21 for tanks and ammunition, $12 for transport equipage and miscellaneous supplies, $10 for naval ships, $9 for industrial facilities, $8 for posts, depots, and stations; $5 for merchant ships, $4 for stockpile and food exports, $3 for pay, subsistence and travel for the armed forces; $1 for housing and $4 for miscellaneous war expenditures. There goes the hundred bucks. The Revolutionary War cost us half a billion dollars, the Civil War 12 billions, and the last war 31 billions. For the present shindig, up until April of this year the cost was 27 billions, and we have voted to spend 160 billions. If every person pledged 10% of his income to buy war bonds, the government would get 11 billion dollars a year, or less than 25% of the 1942 war costs. This should give you an idea of what must be done to help Uncle Sam. Conserve until it hurts, and give until it hurts. Do you know that driving your car 100 miles takes enough gasoline to carry 21 men and 7 guns in 7 army jeeps over 20 miles of open country? Every time one of our tankers is sunk, we lose enough gasoline to drive 13,000 cars from New York to San Francisco. A juke box contains enough brass to make 750 cartridge cases and enough steel to make 5 light machine guns. That is why their manufacture was prohibited. We are

racing against time. Planes, tanks, bombs, guns and ships produced now can decide the war. Waste now can lose the war for us.

● William E. Goewey, from Elmhurst, Ill., writes anent the Sherman-Norris debate (*I. P. Aug.* 1942) regarding female projectionists. He suggests that an organization be formed, such as "League Against Female Projectionists," and that he be appointed vice-president. He states in his letter, "Pity the poor manager when the lady projectionist takes the oil can in hand and prepares to oil the projectors like she oils her vacuum cleaner or washing machine at home. What will she do when she tears a finger nail on that 'nasty, mean sprocket'? Can't you just see the dainty white curtains on the port holes? My heart goes out to the poor projector heads that will be sentenced to take a beating when these women get behind the switch." Well, Goewey, your letter gave me a terrific laugh and I appreciate your sense of humor even though you are discussing a very serious problem.

● Henry Falk, president, and A. J. Mason, chairman of the National Council of Independent Exhibitors of Canada, made application to the Selective Service Board for dispensation from the regulations for projectionists in Canada. They recommended that theatres should be classed as a key industry, so that exhibitors may retain their projectionists. They were given assurance by the Board that the subject would receive consideration. During World War No. 1, our own General Crowder, then in charge of the draft, issued an order placing our members (I.A.) in the "essential class." This was accomplished largely through the efforts of Samuel Gompers, William F. Canavan, Charlie Shay, and F. H. Richardson. Perhaps the workings of Messrs. Falk and Mason will give us something to hang our hats on.

● Jack Winick, old timer and former business agent of Local 306, New York City, was installed recently as president of the New York State League of Masonic Clubs. Jack represented the Projectionists Square Club for a number of years, and attended many I.A. conventions in the past. He also served as delegate at many State Federation of Labor conventions. He is very popular with the membership of Local 306, his most ardent admirer being Alex Polin, also of that local.

● Many of our members throughout the country have entered politics in years gone by and have been successful. At the present time we have an I.A. man in Congress. In 1939, John F. Cassin, member of Local 622, was elected mayor of Port Huron, Michigan. The members of Local 289, Elmira, N. Y., now have the same opportunity, for their business agent, H. Paul Shay, is a candidate for the office of mayor of Elmira. Shay is very well known in the 10th District and is highly regarded by his fellow members. He has been a delegate to many conventions and understands all labor angles. He has been president of the Elmira Central Trades and Labor Assembly (an unsalaried position) for four years. He is a square-shooter and deserves the vote of every working man in Elmira. We hope to announce his election in our next issue—it would afford us great pleasure to do so. Good luck to you, Shay.

● A send-off party was given by Local 253, Rochester, N. Y., for Fred J. Hart, its first member to join up with Uncle Sam's army. As usual, the local did itself proud, and we understand that the party was a huge success.

● The Wartime Wages Control Order issued by the National War Labour Board of Canada states that because of the rise in the cost of living, employers are to pay a bonus to those projectionists who receive a weekly salary of more than $25. Every motion picture projectionist in British Columbia has received this bonus, except those employed by the Famous Players Canadian Circuit. WHY? Incidentally, the bonus amounts to *only* 60 cents per week, per man.

I.P.C. EMPLOYES HONORED

One hundred employes of International Projector Corporation were honored by the President of the company, Earl G. Hines, at International's 24th annual outing on Long Island. Twenty employes who had been with the company 25 years or more received gold watches; twenty who had served from 20 to 25 years were awarded gold "20 year" pins; and sixty, who have served more than ten but less than twenty years, were awarded "10 year" gold pins.

Hasty Changes In Projection Opposed

MAKE no drastic changes in motion picture equipment for the purpose of conserving film until such changes have been carefully studied and experimentally verified by neutral engineers:—this in substance is the recommendation offered to the industry by the Society of Motion Picture Engineers. At the same time the Society strongly emphasized that it favors very prompt adoption of any conservation measure or other improvement which competent engineers find practicable and desirable.

This report and recommendation of the Society was released on the basis of the findings of a sub-committee of its Theatre Engineering Committee. That group delved into proposals currently made for the purpose of meeting the government's demand for film conservation.

The report incorporates a list of eighty-odd carefully prepared questions which should, in the opinion of the S.M.P.E., be applied to any film conservation plan. The questions relate to both studio and projection room aspects of a proposed change. Questions related to the projection room probe into necessary equipment alterations in projector, lamp house and sound apparatus; whether the proposed modification can be made by the projectionist alone or by the projectionist with some outside help, and what effect can be anticipated with reference to existing standards of picture and sound quality. Twenty-seven specific points relating to the projection room are raised by these questions.

As a concrete suggestion, the Society proposes that the industry, government or both set up a staff of neutral and impartial engineers, and provide them with full facilities, for the purpose of testing conservation plans currently proposed and any others which may come up in the future.

Says the report: "The Society . . . is heartily in favor of the adoption of any such methods as, after careful analysis and experimental verification on a minor scale, are proven practicable. It is opposed to hasty and experimentally unsupported action on a large scale. It urges the industry and the government to consider the value of determining basic facts before making fundamental modifications. It stands for completely fair and open minded investigation of facts and prompt action based on such investigation."

The report was released through Donald E. Hyndman, engineering vice president, and Dr. Alfred N. Goldsmith, chairman of the Theatre Engineering Committee.

• BUY WAR BONDS •

First Aid for Shock

By *G. I. SHERMAN, Ph. G.*

MEMBER L. U. 306

SHOCK is present more or less in all serious accidents. It is the condition in which normal activities of the body are in a depressed state.

Symptoms: The face is pale, the skin is cold, the pulse is weak and rapid, patient feels little or no pain but shivers and complains of being chilly.

Treatment: Send for a doctor. Lay the patient down, head flat or lowered. Loosen all tight clothing. Apply external heat with hot water bottles, hot stones, or bricks wrapped in towels. Do not put a pillow under the head of a patient in shock, and do not attempt to help the patient to sit up.

If the patient is unconscious or nearly so, do not try to pour liquids down his throat. Aromatic spirits of ammonia doused on a handkerchief, or smelling salts, placed near the patient's nose may be used to help bring him back to consciousness. When the person revives, a teaspoonful of aromatic spirits of ammonia in a half glass of water may be given as a stimulant, and this may be repeated in half an hour if needed.

Coffee and tea are also good stimulants. Give the coffee or tea as hot as it can be taken with a spoon. Friction may also be applied to the limbs.

Shock results from an injury, but fear or other strong emotion may make it worse. Therefore it is important to cheer the patient and to reassure him in every way possible. If practicable, do not let him see his own injury, for the sight of it may be an important factor in aggravating the condition.

Wartime Line Voltage Needs Careful Watching

Both line voltage fluctuation and sound volume in excess of the safe normal power range of the amplifier must now be watched with especial care. Both are likely to lead to overloading, overheating, and consequent troubles. Line voltage in some communities is today less steady than ever in the past. Where this condition exists, and the power company, after being advised, reports itself unable to remedy it, regulating equipment should be installed very promptly, while it still can be obtained, since otherwise frequent and repeated damage to the equipment may result.

NEW DEVICE FOR RECORDING ON STEEL WIRE PATENTED

A new device for recording sound on steel wire has been patented by the Armour Research Foundation of Chicago. In the Armour machine the wire used is as thin as a human hair. A spool of wire 5 inches in diameter and 2 inches wide will carry an 8-hour recording.

In the new device superior results are obtained, it is claimed, by reducing the spacing between the poles of the magnet to 1/1,000th inch.

MINOR PRODUCERS WILL GET NO MORE 35 MM FILM

Producers who make pictures on speculation, without definite release arrangements, makers of road show features for small theatres, of dialect films, negro pictures with colored casts and the like, will get no more 35 mm film, under conservation orders of the WPB. Appeals from the ruling may be taken, in individual cases, to Lowell Mellett, whose decision will be final. Film will be sold, however, to any producers releasing their products through the major distributors.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933,

Of INTERNATIONAL PROJECTIONIST, published monthly at New York, N. Y., for October 1, 1942.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared R. A. Entracht, who, having been duly sworn according to law, deposes and says that she is the Business Manager of INTERNATIONAL PROJECTIONIST and that the following is, to the best of her knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, International Projectionist Pub. Co., Inc., 580 Fifth Avenue, New York, N. Y.

Editor, Aaron Nadell, 580 Fifth Avenue, New York, N. Y.

Managing Editor, None

Business Manager, R. A. Entracht, 580 Fifth Avenue, New York, N. Y.

2. That the owner is:

International Projectionist Pub. Co., Inc., 580 Fifth Avenue, New York, N. Y.

R. A. Entracht, 580 Fifth Avenue, New York, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

Ruth A. Entracht, Business Manager

Sworn to and subscribed before me this 25th day of September, 1942.

(Seal) OTTAVIO GRIMALDI

Notary Public, Nassau County Clerk's No. 621, Certificate filed in New York County No. 4-G-56; New York County Register's No. 86. My commission expires March 30, 1944.

FOR VICTORY TODAY AND SOUND BUSINESS TOMORROW

Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

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If your firm has not already installed the Pay-roll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

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iP

NOVEMBER 1942

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S C O R I N G   V I C T O R I E S

with Victory Carbons

The manner in which the motion picture industry has accepted and so quickly adapted itself to the use of the new Victory High Intensity projector carbons is worthy of the highest praise.

This effective cooperation on the part of theatre owners, projectionists, lamp manufacturers and distributors has shown what unified patriotic effort can do in scoring victories. A large quantity of copper has been conserved for the nation's war effort, economies have been made in power and carbon consumption and, at the same time, a general high standard of screen illumination has been preserved to the great satisfaction of the nation's vast motion picture audience.

Refer to the following table if you have not yet used the new Victory Carbons. It will help you select the proper size and type of carbons for use in your equipment.

The new Victory Carbons are identified by the "National" trade-mark imprinted in *white* instead of the familiar *blue*. Maximum allowable arc current is also stamped on each carbon. It is important that this current limitation be observed.

A complete bulletin giving details of the application of the new Victory High Intensity Carbon is available on request.

The words "National," "Suprex" and "Orotip" are trade-marks of National Carbon Company, Inc.

Save the Copper

Most of the copper used for plating copper coated projector carbons drops to the floor of the lamp house when the carbons are burned. Continue to save these copper drippings and turn them over to an authorized scrap dealer or to such other agency as may be designated by our government.

RECOMMENDED TRIM AND RANGE OF ARC CURRENT FOR LAMPS USING COPPER COATED, HIGH INTENSITY, PROJECTOR CARBONS

Type of Arc	*Arc Current — Amperes*	*New Victory Carbons — Size and Type*
"1 Kw" High Intensity, A.C.	52-66	7 mm x 9 inch H.I., A.C. Carbons in both holders
"1 Kw" High Intensity, D.C.	40-42	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *adjustable* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 6 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C. with *fixed* feed ratio	42-45	7 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative
Simplified High Intensity, D.C.	56-65	8 mm x 12 inch or 14 inch "Suprex" Positive 7 mm x 9 inch "Orotip" C Negative

NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide and Carbon Corporation

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International PROJECTIONIST

With Which is Combined PROJECTION ENGINEERING

Edited by Aaron Nadell

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Monthly Chat

NEARLY a quarter of a million pounds of copper a year, according to the most recent estimates, will be saved for the war effort through conservation of carbon drippings. And they say there is no substitute for copper as the driving band of an artillery shell. The metal has just the right characteristics. Wonder how many shells half a million pounds of copper will take care of?

• • •

Charles Butler of New York City writes as follows:

"We think one more contribution theatres can make to the war effort, directly or indirectly, is the salvage of old film lying on the shelf or in a back room in every booth. In our own we have about two thousand feet of old special Bingo games—special Christmas programs—bank nights, etc., etc., etc., the accumulation of many years. We would like to see it directed into the war effort for as we all know because of its composition with little conversion it could help blast the Hell out of our enemies."

Butler may have something there. I.P. is going to inquire into it, and will report back to the craft in a future issue.

• • •

Certainly the armed forces are not exactly contributing to the economic stability of the post-war period when they train green men to projection work while failing to utilize the experienced projectionists in their ranks. For winning the peace won't be helped by adding needless economic complications to the plentiful crop of complications that will be present in any case. Further comment on this subject will be found in Harry Sherman's pages.

• • •

And yet wars do strange and unpredictable things. While the armed forces (and we hope the practice is stopped, promptly) try on the one hand to train projectionists that may never be needed in time of peace, on the other hand those same armed forces foster the development of all sorts of unheardof gadgets, some of which will certainly turn up in peacetime form in the nation's projection rooms. What with war-encouraged television practically a certainty, and devices now unforeseeable a strong probability, perhaps the post-war need will be for three men to every shift. Television alone would almost demand that expansion.

• • •

I.P. is now settled in its new offices (19 West 44th Street) and very comfortable, thank you. Come up and see us sometime. A. N.

INTERNATIONAL PROJECTIONIST

VOLUME XVII NOVEMBER 1942 NUMBER 11

Analyzing Amplifier Diagrams

II.

By LEROY CHADBOURNE

Showing how complex diagrams of theatre amplifiers can be analyzed into a large number of simple circuits, each of which can be treated individually.

IN FIGURE 1, here reproduced, as in the diagram printed last month, it is comparatively simple to reduce the entire schematic to a set of separate, independent circuits, each consisting of a source and load; and then, in making repairs of tracing trouble, treat each circuit as a separate entity.

It is true these circuits are not entirely distinct from each other; they overlap, they share the same wires in places. But this complication need not be troublesome. In a common d.c. or single-phase a.c. three-wire Edison system different circuits share the same "neutral" but they remain separate circuits in spite of that.

A similar example in Fig. 1 would be the two plate circuits (power and speech circuits) of the left-hand amplifier tube, V-1. Consider the power circuit first. Find condenser C-6 by tracing from the plate of V-1 right and down through R-3 to the top of C-6. The other side of C-6 is connected to the ground bus of this amplifier. Now let C-6 be regarded as the source of the plate power circuit of V-1. Of course the condenser is not a source of power. But power is brought to its terminals from the right-hand end of this drawing, as can be traced separately, and the terminals above and below C-6 can be regarded accurately as distribution points through which plate power is supplied to V-1.

From this negative distribution terminal, the lower plate of C-6, trace left and upward through R-7 to the cathode of V-1. Continue (tracing from negative to positive) by emission across V-1 to its plate; from the plate right and down to R-3 to the positive distribution point, the upper plate of C-6. This is one complete circuit, with the connections above and below C-6 representing the source terminals, and the cathode and plate prongs of V-1's socket representing the negative and positive terminals of the loading device. R-3 and R-7 are in series with the load.

The fact that there is no actual generator or source of power in this circuit as traced means no more than when, in tracing a projection room power line, one traces as far back as the switchboard terminals. That's far enough. For understanding that particular circuit there's no need to go to the meter board in the cellar, or beyond that to the power house. In exactly the same way, there is no need in the present case to go back to the ultimate source of power elsewhere in this amplifier, if the plate circuit of V-1 is the only thing that needs consideration.

But, it may be asked, how is it possible to find out that the source terminals of this circuit happen to be the upper and lower plates of C-6, unless the whole power line is traced back to its origin? In common amplifier practice the plate of an amplifying tube is always positive, and the cathode is always negative, returning to negative in most cases through a bias resistor; moreover the negative is almost always grounded. C-6 is obviously a filter condenser connected across the plate power line from positive to ground. The fact that the lower side of C-6 is grounded is easily checked in the drawing without going all through the power circuits. And it is likewise easy to see that the upper side of C-6 is wired to the plate of V-1 through the plate resistor, R-3.

The speech circuit in the same wires may be taken as having for its source terminals the cathode and plate binding posts of V-1 socket. The primary winding of transformer T-5 is the essential load. The drawing is somewhat smudged at the bottom of T-5—terminals 4 and 5 of that transformer are linked together, inasmuch as both go to ground. In series with the load are C-2 and C-1 (the V-1 grid bias bypass condenser); and connected across the line are R-3 in series with C-6. This speech circuit is complete in itself and can be investigated

throughout without referring to any other part of the drawing. The saving of time, when symptoms indicate trouble in that circuit, is obvious.

Other Circuits of V-1

Two other circuits share portions of this wiring. There is the speech input circuit, the source terminals of which are the top and bottom of the secondary of transformer T-1. The cathode and grid connections of V-1 socket may be considered the load terminals. Of the two wires of this circuit, one runs from the top of the secondary to grid through a grounded coaxial cable; the other from the bottom of the transformer to cathode through C-1, which is in series.

The grid bias circuit of this tube may be taken as having its source terminals at the top and bottom of resistor R-7. The plate current flows through this resistor, as already traced; hence, there is a voltage drop across it, and it can be considered as a source of voltage. The top or positive terminal is connected directly to cathode. The lower or negative terminal is wired through R-1 and T-1's secondary to grid. The grid is thus biased negatively by the extent of the voltage drop across R-7. The nominal plate current of 2.8 mils, flowing through R-7's 1,700 ohms gives ($I \times R = E$; $.0028 \times 1{,}700 = E$) 4.76 volts negative bias for the grid of this tube.

In this moderately complete check of all the circuits of V-1, no necessity has been found for looking to any other part of the diagram, except one glance to confirm that the bottom terminal of C-6 is grounded; a fact obvious anyhow since that terminal connects with the cathode return of V-1. A large number of troubles associated with V-1 could be investigated with the help of this diagram, without taking time to check on any other part of the circuit except those portions that have been traced thus far.

Diagram investigation is not always, of course, as simple as in the examples just chosen. A good deal depends on how a schematic diagram is drawn; sometimes draftsmen complicate matters for the reader. But in many cases a diagram must be so drawn that it is necessary to search for a needed source or load or connection. Consider for example, R-7, bias resistor for V-1, drawn in series with V-1 cathode return in such a way that its function is obvious; and by contrast, look for the grid bias resistor of the output stage. It is not drawn near the tubes at all.

The Output Circuits

To find the bias resistor for tubes V-3 and V-4 it may be noted first of all that the cathodes of those tubes are also the filaments; there are no separate cathodes; therefore the plate current return to negative is through the filament circuit in this instance, and it is that circuit that must be traced for the bias resistor. The filament connections run down to the second secondary from the left in transformer T-4, and the complete filament circuit is from either end of that secondary, up to one side of the filaments, through the filaments, and back to the other side of that secondary. No resistance is in the line anywhere, but also, no return to the plate circuit negative—no ground. But there must be a return to the plate circuit from the filaments of those tubes, or their plate circuit would be open. The secondary referred to has a center tap, which is wired to ground through R-4, 680 ohms. R-4 then ought to be the bias resistor for V-3 and V-4, and 680 ohms looks like roughly the right value.

These tubes have a nominal plate current of 45 mils each, or 90 mils for both, roughly 1/10th ampere: $1/10 \times 680$ ($I \times R$) gives 68 volts grid bias for these power tubes; more accurately, $.09 \times 680 = 61.2$ volts bias at the nominal plate current of 45 mils per tube.

Another glance at the filament line of these tubes shows it has no connection to any other circuit except through R-4; therefore R-4 must be the bias resistor. Its upper end connects to ground, the most negative part of the plate circuit; its lower end therefore must be the positive terminal of R-4 regarded as a source of voltage. This positive terminal connects to the filaments of the tubes through the trans-

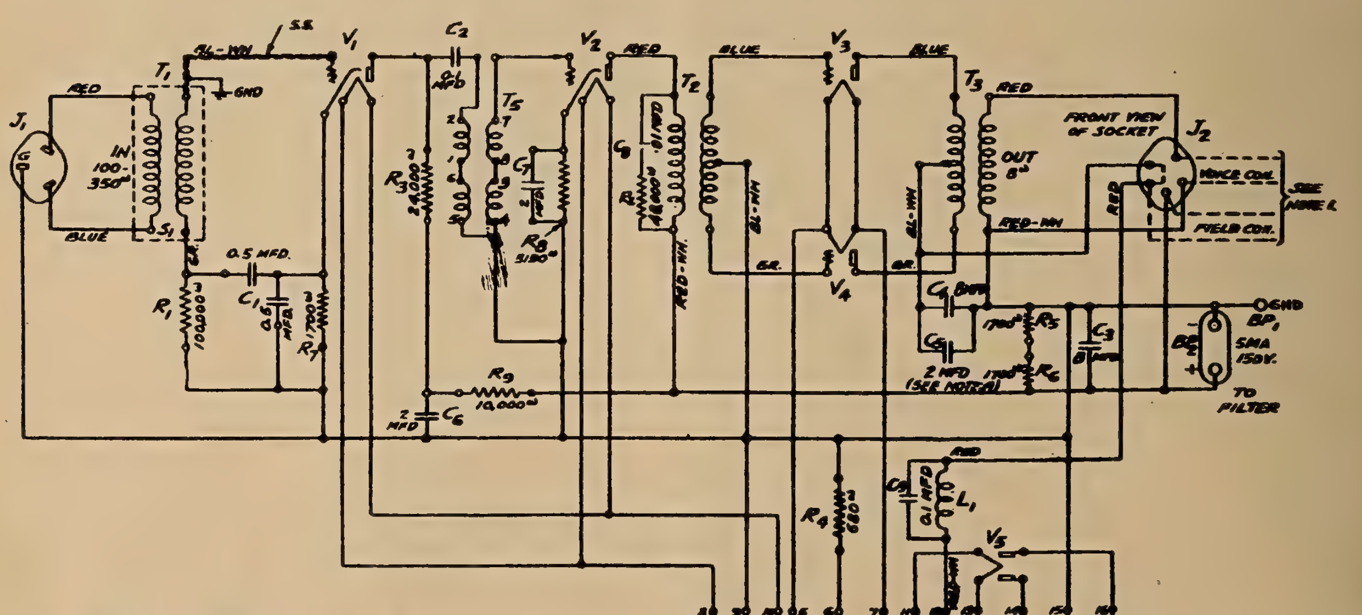
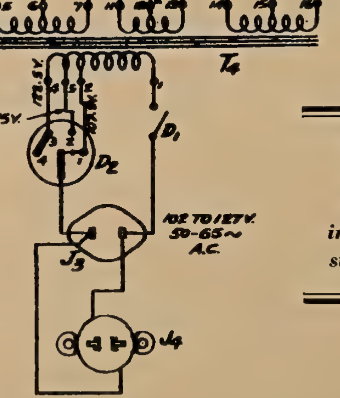

FIGURE 1

This complex circuit can be analyzed into twenty-five simple circuits.

former secondary. The negative (or upper) terminal of the same voltage source must connect to the grids of V-3 and V-4, and may be traced to them as follows: up, left a little to the first junction point; up to the center tap of the secondary of T-2; through that secondary to the two grids. The circuit is complete. It is very similar to the circuit previously traced, in which R-7 was regarded as a voltage source, but a little less simple to see by a glance at the diagram; some slight checking of connections is needed to uncover it.

For the plate supply to V-3 and V-4 it may be enough for a given purpose to locate some convenient distribution point as the positive terminal of the source of power. An easy one is the center tap of the primary of T-3. We know power must reach the plates of those tubes, and the center tap of T-3 primary is the only external connection to their circuit. Here, then, is where plate power must come in, there is no other junction through which it can enter. Call the center tap of T-3 primary the positive terminal of the plate power source; call the upper end of R-4, as just traced, the negative source terminal; call the plate and filament binding posts of V-3 and V-4 the positive and negative terminals of the load. The circuit is complete.

It may be necessary to find out how power gets to the center tap of T-3 secondary. Perhaps a voltmeter check has shown there is no voltage there. It is not hard to trace back from that point to the positive side of the power source. That's like tracing back from the projection room switchboard to the meter board in the cellar. From the center tap in question a black and white wire runs downward. From this wire three lines branch to the right; those are the only connections to it. Two of them, however, are blocked by condensers, through which d.c. won't flow; the third, the top connection, must be the one that runs back to the positive side of the power source. It can be traced back right, up and right to a jumper in receptacle J-2. There a dotted line branches off; the drawing says it goes to the field coil of a loud speaker; trying the other line first, this is found to run left, down and left to the top of L-1, and through that coil to the center tap of the rectifier filament secondary, which is the positive terminal of the ultimate source of power. The negative terminal of this source is of course the center tap of the plate secondary of the power transformer, and this tap is easily traced back to the top of R-4; also it can be traced (straight up as far as possible, and then right) to ground.

Three of the seven circuits of the output stage have now been traced; the filament, the grid bias and the plate power circuits; and in addition the plate power circuit has been run back beyond convenient distribution points to its ultimate source.

The other four circuits are those for speech input and speech output. One speech input circuit may be traced from one load terminal (the filament of the lower tube) down, through the transformer winding, up through R-4, left to the next junction and up to center tap of T-2 secondary, a source terminal. From the other load terminal, the grid of the lower tube, trace straight left to the other source terminal. Similarly with V-3, its load terminals for speech input are its filament and grid connections; the source terminals of its speech input are the top and center tap of T-2 secondary. These circuits share all the wiring of the grid bias circuits; grid bias and speech input being in series.

The source terminals of the speech output circuits are the plate and filament of each tube; the load terminals are the two ends of T-3 primary, and the center tap of that wiring—which is the common load terminal connecting to both filaments as its sources. The connection is readily traced: down the black and white wire as before, and right through C-4 and C-5 to ground. The filaments also are grounded (as repeatedly traced) through R-4. The fact that there is no by-pass condenser around R-4 to carry the current of the speech output circuit introduces a certain amount of reverse feedback into this stage of amplification which acts to improve sound quality.

None of the circuits of V-2 has been traced for the reader, and the plate circuit of V-1 has not been traced further back than C-6, taken as a distribution point. The reader may wish to locate and identify those circuits of the diagram for himself, following the procedure used above. That procedure is: in the case of any load, find its two terminals. Locate two terminals of a source supplying that load: connect source terminals with load terminals. For instance, in the case of speech input to V-1, the secondary of T-1 was taken as the source. It was not necessary to go further back to the primary of T-1, and thence to the incoming line—that is another circuit.

S.M.P.E. Meets--Elects Griffin President

HERBERT GRIFFIN, vice-president of the International Projector Corporation, is now President of the Society of Motion Picture Engineers, having been elected, at the October convention at the Hotel Pennsylvania, New York, to succeed Emery Huse. Griffin has been a pioneer in the development and improvement of projectors since 1907. Elected with him, as Vice President, was Loren L. Ryder, director of recording for Paramount.

The usual Spring convention of the S.M.P.E. will not be held in 1943, it was decided, because of war conditions.

The award for the best original paper

Herbert Griffin

printed in the Society's "Journal" for 1941 was won by Donald Mackenzie and Walter J. Albersheim, both of Bell Telephone Laboratories, for their joint paper, "Analysis of Sound Film Drives." In this contribution, which appeared in the November, 1941, issue of the "Journal", stabilizers for controlling film motion are analyzed mathematically in great detail, as if they were electrical filter circuits, and as if the vibrations to be removed were electrical frequencies to be filtered out of direct current—the direct current representing the steady driving force. The practical result of Mackenzie and Albersheim's mathematical analysis was the production of film drives with less flutter than any drive previously known to the art, according to measurements taken with a flutter bridge.

Because of the war the progress medal was not awarded this year.

The three-day convention was marked by the reading of many papers on 16-millimeter equipment and procedures and by strong emphasis on wartime uses of motion pictures. Film development techniques also received a large share of the interest of the members attending the meeting.

Highlighting the discussions relating to 35-mm projection were two papers by E. K. Carver, R. H. Talbot and H. A. Loomis, all of Eastman Kodak Company, which were read in sequence by Dr.

(*Continued on page* 18)

I. P.'s Contest Proves Ingenuity of the Craft

If there are still any persons who are critical of the competence and skill of American and Canadian projectionists they would certainly be silenced could they go through the sheaf of answers to I.P.'s first contest question. A problem was presented that was both tough and unusual; from every direction came solutions to it that were practical, eminently workable in an emergency, highly ingenious, and based on thorough understanding of the principles of projection room apparatus.

Several of the contestants, moreover, deliberately made things harder for themselves by adding to the conditions of the contest; for example, by specifying that the breakdown took place in the evening hours when sources of every possible emergency gadget were closed. They did not have to specify that. These men made the problem tougher than I.P. had made it—and then proceeded to present excellent solutions.

Outstanding in evidence of the way the craft accepts its responsibilities is the fact that a number of contestants describe emergency appliances with which they have provided themselves in advance, and which they keep in the projection room in order to be prepared for any eventuality.

The answers show not only a firm grasp of the nature of the problem, and ingenuity and practical sense in meeting it, but a broad background of electrical knowledge which enabled a number of contestants to suggest that voltage-multiplier circuits be substituted for the burnt-out transformer, and further to include diagrams of such circuits and how they should be connected to a theatre amplifier. Other readers described in detail how two more transformers taken from old radios could be interconnected to provide the voltages and currents required.

All in all, the craft displayed ample understanding of its business, and if any adverse criticism of this showing is in the least justified, it can only be that some of the contestants were a bit vague on some details. Several contestants whose solution was entirely sound in principle overlooked apparent trifles that would have made it unworkable or doubtful in practice. An example of this would be the fairly large number of suggestions involving the use of *B* batteries. The fact happens to be that *B* batteries are under priority restrictions; and even if a priority number could be obtained there would be considerable doubt about finding enough batteries to keep a theatre-sized amplifier running several weeks. Similar considerations apply to the suggestion that old radio transformers be used. Old radios are no longer a "drug on the market," as one contestant describes them; the government wants every one, either for training purposes or for scrap metal, and the few that are still around at this writing will not be available long. However, it remains possible to wreck some good radios if theatre necessity requires.

All readers did not take the last possible detail into account in describing the application of their remedies; and some admitted this frankly by such phrases as: "let's hope the transformer . . . . was designed with a large enough safety factor," in connection with a suggested substitution.

Then there is the very excellent letter of one contestant who elaborately worked out a method of using electric lamp bulbs in series as a voltage divider to step down power line voltage for the purpose of heating his amplifier filaments. This reader applied Ohm's Law in detail and successfully, calculating his voltages, and the wattage the divider could withstand, with a high degree of accuracy; but he forgot his amperage requirements and proposed to draw 6.6 amperes from a voltage divider which by his own figures could not admit as much as 0.2 amp. This same contestant writes: "Emergencies like this should be doped out in advance, and in my opinion that is the prime benefit of a contest of this kind."

It was not easy to pick the prize-winners out of so many excellent replies. The decision was made only after days of conscientiously reading and re-reading every answer received, and this much should be added: If all of the present prize-winners were eliminated, if not one of them had competed, the awards could still have been granted, with ample justification, to those who are now listed for honorable mention, and the showing of the craft would still have been superb.

The most completely practical solutions to the problem fell into two groups. A number of contestants described emergency appliances which they have built

(*Continued on page* 21)

Winners of the September Contest

1st Prize

James W. Tarr
Cozy Theatre
St. Joseph, Mich.

2nd Prize

Maurice Rushworth
New Theatre
210 West Lexington Street
Baltimore, Md.

3rd Prize

Francis L. Hill
Florida Theatre
St. Petersburg, Fla.

Winners of One-Year Subscriptions to IP

Ed Howson
P. O. Box 329
Watertown, S. D.

M. J. Nederostek
2001 Green Street
Allentown, Penna.

Robert E. Cable
342 North 10th Street
Lebanon, Penna.

C. H. Perry
47 Eyre Street
Sudbury, Canada.

H. D. Taylor
1516 Greenwood Street
Raleigh, North Carolina.

Alanson M. Kittredge
Apt. 5, 430 Irving St., N. W.
Washington, D. C.

Honorable Mention

Martin Teker
Sheridan, Mont.

Charles Butler
217 East 88th Street
New York, N. Y.

Fred Bendell
104 Alder Street
Sudbury, Ont., Canada.

William J. Schmitz
61 Oakdale Boulevard
Pleasant Ridge, Mich.

William Goewey
658 Spring Road
Elmhurst, Ill.

Chas. W. Cook
119 Brown Street
Santa Rosa, Calif.

Paul Cota
Palace Theatre
Mason City, Iowa.

D. D. Demick
1303 North Cedar
Tacoma, Wash.

L. V. Steele
Rialto Theatre
Plymouth, Ind.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random: fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

HERE's a suggestion in cleaning burnt film accumulation after a fire in projectors and soundheads; remove all excess burnt film, then dismantle all parts necessary for a complete job; now place all parts in a pail of plain water; let them soak for about half hour. Use a tooth-brush on the parts in question until all signs of burnt film or soot are gone. Great care must be exercised to prevent the formation of rust on all steel parts, such as sprockets, tension shoes, and shafts, therefore, all parts should be dried immediately upon removal from the water; however, if you can get kerosene, make up a mixture of one-third kerosene and two-thirds water. This will obviate the care necessary in getting the parts scrupulously dry since the kerosene in the water will protect the parts from rusting. This is an old trade secret and has always worked well in all fire jobs.—NAT RIPP, *RCA, New York.*

• • •

Now and then a stock No. 29474 AC switch on an Erpi 42 amplifier will appear to be worn out or otherwise defective, failing to snap into position and failing to make contact when the knob is twisted. The effect is the same as if the spring were broken or had lost its tension. This effect is usually the result of lack of lubrication. A little oil applied with the aid of a toothpick on the rear end of the shaft and washer, and on the shaft in front of the contact terminals, will make the switch "snap" in position like a new one.—P. C. HUMPHREY, *RCA, Boston.*

• • •

In connection with the adjustment and operation of Peerless Magnarc Lamps, I have noted the following which may be of some value in getting the maximum amount of light. In practically every case where this lamp is installed on a W. E. Universal Base it will be noted that the lamp sits from 1/8 to 1/2 inch too low. In other words, the optical center of the lamp is not in line with the optical center of the aperture in the head and of the lenses. This can be checked in a number of ways. A rough test can be made by checking to see whether the cone on the front of the lamp is centered with the cone on the rear shutter.

A more accurate method is as follows: Close the dowser on the front of the lamp. Then light the lamp with the side door open (stand back of the reflector to prevent blinding) and adjust the reflector so that the spot of light is centered on the dowser at the front of the lamp. Then open dowser. If the lamp is properly aligned with the head, the spot will be properly centered on the aperture plate.

A still more accurate method, which will also check the side adjustment of the lamp, is as follows: Light the lamp and adjust the reflector to center the spot on the aperture. Then insert a piece of tin having a hole in the center into the aperture, clamping it in place with the light gate so that the hole is exactly in the center of the aperture. Insert a piece of string or fine wire through the hole in the tin and measure the distance from this hole to various points on the circumference of the reflector. If the alignment is correct these distances will all be the same. If the alignment is incorrect these distances will vary, indicating that the reflector must be set at an angle with respect to the aperture and the lens surface. As a result, the light is not entering the lens squarely and some of the light is lost.

I have corrected the alignment of quite a number of lamps with a noticeable increase in light and improvement in light distribution. For the purpose of raising the lamps I have been using strips of 1/2 or 3/4 inch perforated pipe strap hanger, using as many thicknesses as needed. These were placed directly under the lamp, i.e. between the lamp and the bracket. They were cut slightly longer than the bracket and bolted to the bottom of the lamp so that the lamp can be slipped forward and backward in the track on the bracket. The proper holes for mounting screws were reamed out of the shims.—G. B. BROWN, *ALTEC, Chicago, Ill.*

• • •

The Solar CE Condenser Checker is very good but it has one hazard which should be and can be easily corrected. For purposes of "Quick Check" the case of the tester is connected to the high voltage divider at a potential of about 450 volts. When making leakage tests on condensers in a chassis or rack this means a 450 volt difference between the amplifier or filter chassis and the tester. All you have to do to start the fireworks is to touch both at the same time. To correct remove all case grounds to an insulated bus and connect a switch between the bus and the case. The switch can be off except when using it as quick check and in this test there is no high voltage on the test leads anyway. The present condition is apt to be hard on both hearts and equipment.—R. A. CRANE, *ALTEC, San Francisco, Calif.*

• • •

I have found the use of Marr. No. 2 wire connectors a great convenience in connecting the AC and DC splices to KS-5259 motor generator sets. These connectors are solderless, they connect the wires by means of a set screw with a plastic screw cover. They afford great convenience when necessary to disconnect either motor or generator, for repairs or emergency operation with batteries. The connectors can be secured in any electrical shop.—R. A. MACDOWELL, *ALTEC, Rochester, Minn.*

MAINTAIN EQUIPMENT OR CLOSE HOUSE—GREEN

"Theatres are essential only relatively," warned Walter Green, president of National Theatre Supply Company, in an address to exhibitors in which he cautioned them that every possible effort must be made to keep theatres running, and to maintain existing standards, with equipment on hand.

If such effort is neglected or skimped, Green said bluntly, "we curtail the overall possibility of keeping our theatres open."

The NTS president promised that his company and all other supply sources would help in every way they could. But none can do the impossible, he added, and a large part of the burden lies with the theatre, which must exhaust every method of keeping existing equipment running and in good condition.

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HENRY UDOVICH

† A list of I.A. men previously called to the colors was printed in I.P. in March, 1942.

In The

SPOTLIGHT

By HARRY SHERMAN

A FLASH comes from Hollywood that the Office of War Information has an extended program of 16 mm. pictures ready for distribution in about 80 of our larger cities. These "morale pictures" will be shown in factories, schools, and wherever their message can be brought to the attention of the general public. Take a tip, business agents, and see that your men are placed on these jobs. The government agencies will not do anything detrimental to organized labor, so do not let this opportunity slip through your fingers.

● We are happy to report that Frank Luckner and John F. Short, president and business agent, respectively, of Corning, N. Y., Local 480, were successful in obtaining for their members new two-year contracts with the Schine interests. The contracts call for a 5% increase the first year, and an additional 5% increase the second year. Good work, boys, we are always happy to pass such news along.

● In recognition of past services rendered, Clyde Cooley, of Omaha, Nebr., was recently re-elected secretary-treasurer of the Nebraska State Association of the I. A. T. S. E. That's the idea, boys, when you get a good man on the job, keep him there.

● There is a unique organization in New York City called the "25-30 Club," whose membership of 250 is made up of a group of projectionists who have been members of Local 306 for 25 years or more. These men joined the union in its early days and have kept up their membership ever since. Among the membership will be found such old-timers as Morris Rotker, Dave Narcey, Alex Polin, Ben Stern, Bob Sanders, Abe Lang, Harry Bergoffen, Harry Rubin, Jack Winick, Morris Kravitz, Joe Pearlman, Joe Basson, Pete Finelli, Al Lee, Hank Fuller, Tommy Forresteri, Phil Lynch, Jimmy Ambrosio, Harry Sherman, and many others too numerous to mention herein. There are but four honorary members, namely, P. A. McGuire, of the International Projector Corp.; William C. Kunzmann, of the National Carbon Co.; James Lynette, Chief Inspector, Department of Water Supply, Gas and Electricity for the City of New York and Bart Greene, his assistant. The 25-30 Club is non-political; it meets monthly and union matters are not permitted to be discussed at the meetings. The Club has a Constitution and a set of By-Laws; election of officers is held yearly. The present officers are Mike Berkowitz, president of the club since its inception; Morris Klapholz, secretary, and Henry Weinberger, treasurer. Henry Weinberger, by the way, worked at the Metropolitan Opera House way back in 1894. A dinner and dance is given each year for the benefit of the sick and distress fund, and this year's party will be held on the 22nd of November. Many stage, screen, and radio stars are expected to attend.

The insignia of the 25-30 Club is an I. A. button with a gold bar running across the face of it on which is embossed "25-30." In the center of the button, in place of the local number, appear the letters "NYC." This is an open invitation to other locals to start such a club of their own.

● One of the reasons for the industry going over the top in its billion dollar war bond drive, was the wire sent out in advance by the I. A. home office to all locals throughout the country urging them to boost the sale of war bonds. The locals responded by going on a war-bond-buying spree that helped in a great measure to make the industry drive so successful.

● The projectionist running the film effect in the show, "Hellz A Poppin," now playing in Chicago, is Billy Gluck, member of New York City Local 306. Billy has had this run for the past four years, and is beginning to look like some of the performers.

● Here is a reverse angle to the "labor shortage." Pete Docter, member of Local 164, Milwaukee, Wis., helps out in his off time with the harvesting of the corn crops. If there is a shortage of labor, it is not in our craft.

● We are sorry to report that William D. (Bill) Lang, member of New York Local No. 1 and also of the Westchester County Local No. 650, has been ailing for quite some time. Bill is not a youngster, for he was a business agent of the old Local No. 35 of the Calcium Light Operators the year I was born. (This calls for some pretty snappy figuring.) In later years, under William F. Canavan, Bill became the manager of the Claim and Adjustment Departments. Too many words of praise cannot be written for the kindness and thoughtfulness of Arthur Martens, Dick Hayes, and the late Jimmy Shaughnessy of Local 650 for their humane feelings in seeing that Bill Lang is well taken care of in his old age—and we mean very well taken care of, too. We are rooting for you to pull through, Bill, and promise to take you over in another game of pinochle.

● Texas has just added another local to the I. A.; there are now 41 I. A. local unions in that state. Eddie Miller, I. A. representative, assisted by Max Ealy, business agent of the Wichita Falls local, organized the men in Vernon-Childress, henceforth to be known as Local Union No. 765. This Miller guy is a live wire—always one step ahead of the other fellow. The new men immediately went into action and elected their first set of officers, namely, Albert A. Pearson, president; Almer G. Cotton, vice-president; Allen Murphy, secretary-treasurer and business agent; Aubry Stringer, recording secretary, and Homer Gimlin, sergeant-at-arms. The very first bit of business put over by this new local was to subscribe to INTERNATIONAL PROJECTIONIST for its *entire membership*. Thanks a lot, boys, and good luck to you.

● Here we go again. How about the locals sending cigarettes and comfort kits to their members now in the armed forces. Christmas and New Year will soon be here and if you want the men to get their gifts in time for the holidays, you had better get busy at once. Time is getting short.

● Leave it to the S. M. P. E. gang to throw a party! We attended the dinner-dance held at the Hotel Pennsylvania, October 28, and can honestly say it was one grand affair. Bill Kunzmann, in charge of the entertainment committee, did a swell job. Excellent music and dancing, plus the presence of the lovely

ladies, helped make it one of the most enjoyable evenings we have had in a long time. With the exception of a few introductory remarks made by E. A. Williford in his usual witty fashion, and the presentation of the S. M. P. E. award, there was practically no speech making —an innovation other parties might follow. Seated at our table were Thad Barrows and Joe Cifre, of Boston; Local 306 President Herman Gelber and his charming wife; F. H. Richardson (who needs no introduction); Jack Sawyer, Buffalo; Mr. and Mrs. Harry Hollander; Paramount's Harry Rubin; Earl Morin, Karl Brenkert, and I. P.'s own Ruth Entracht, Aaron Nadell, plus yourly truly. Karl Brenkert amused the party with his drolleries and his terpischorean efforts, particularly those along the Oriental lines. Joe Cifre proved himself a singer of great range when he yodled a Chinese love song to Mrs. Lo, wife of one of the Chinese guests present at the party.

● Herb Griffin, newly elected president of the S. M. P. E., is a veteran member of Local 306, and is also a member of the 25-30 Club. Herb, I have been reliably informed that the authorities will lift your license if you don't come back to New York to operate a projection machine for at least one day. Not even the vice-presidency of the International Projector Corporation will save your license for you, so take a tip and pick your booth.

● There is a new loudspeaker at the home of RCA's Ed Cahill. It's a boy and Ed is strutting around town these days prouder than a peacock!

● Local No. 171, Pittsburgh, Penna., is now in the hands of its new officers, who are sincere in their efforts to make 171 one of the outstanding locals in the Alliance. From present indications it seems that they will be successful. Seventeen members of the local, including Paul Ferry, Luther Thompson, and Roy Grove attended the Walsh testimonial dinner and they certainly made a fine looking aggregation.

● A new two-years' contract between Chicago Local 110 and the exhibitors is now being negotiated. The local is asking for a six-day week, vacation with pay, plus a 10% increase in salary. Thus far we understand that the exhibitors have offered a 2½% wage increase, which was at once turned down by the membership. We should like to see Local 110 gain all points. The Chicago exhibitors have had some swell financial seasons and should be willing to give a small portion of their profits to the men who are largely responsible for the increased box office receipts. A poor projectionist can ruin the best picture made. A first-class show demands the services of a first-class projectionist, and as such he is entitled to the remuneration given any first-class workman in his particular field. We cannot understand these exhibitors who will haggle and wrangle over a paltry few dollars a week increase for projection room costs, and then spend thousands upon thousands of dollars in decorating and re-decorating their theatres. *Again we repeat, patrons pay for what is shown on the screen and not for new carpets and plush seats.*

● **At last the inevitable has happened. Wallace Rainwater, secretary of Local 506, Anniston, Ala., has been notified that his son, Robert Rainwater, member of the Shelbyville, Tenn., Local No. 713, is reported missing in the line of duty. We regret very much to report such news and wish to extend our deepest sympathy to the Rainwater family.**

● After servicing the Garden Theatre, Toronto, Canada, with excellent projection (furnished by Local 173) for the past 25 years, the management suddenly decided to operate the theatre with non-union men. A contract was signed with the National Motion Picture Operators Union, Local No. 10, an affiliate of that Canadian rump union, and Local 173 (I. S. T. S. E.) men were thrown out of their jobs. With men like Covert, Ayers, and Milligan on the scene, we are of the opinion that it will not be long before the Garden Theatre is back again in the I. A. fold.

● Thad Barrows and Jim Burke, president and business agent, respectively, of Boston Local No. 182, advise us that the war will soon be over. Jake Adams and Mike Keller, members of Local 182, are now officers in Uncle Sam's Navy, and from now on it is going to be pretty tough sledding for the Axis subs. Axis papers please copy.

● We were taken to task by a member of a mid-western local who is now in the armed forces because we are constantly harping on the fact that neither the army nor the navy place our men at work projecting motion pictures, but take men who in civilian life worked in other fields of endeavor and train them for projection work. To prove that our contention is correct, we may mention here that in a recent edition of the New York Times there appeared an article stating that the navy had just held its first "commencement exercises" for a class of men who were specially trained for motion picture projection work. No mention was made of the professional projectionist who had enlisted in the navy—no reason was given why he was not assigned to do the work for which he was expertly fitted. A great deal of prominence was given to the fact that the navy took untrained men and trained them for work with which they were wholly unfamiliar before entering the service. We understand that several such graduations have taken place in the Brooklyn navy yard; what the other yards are doing in this respect we do not know at the moment. Lieut. Com. Conrad Jacobson, of the Brooklyn Navy Yard, has 21 men in his department who review approximately 300 pictures a year, and these men train the students in the operation and repair of sound motion picture equipment. The graduates of these classes are then assigned to ships as projectionists and electricians. This same procedure, we understand, is also prevalent in the army. What will happen to the craft when the war is over, and how will these newly trained projectionists compete with our own highly trained men? Equipment worth millions of dollars is placed in the hands of these amateurs—delicate equipment that is extremely difficult to replace these war-torn days. Why isn't something done to bring this matter to the attention of the proper authorities in Washington? Elsewhere in this issue you will notice an advertisement calling for motion picture operators for service in the Canal Zone. *These jobs should be taken by I. A. men wherever possible, to prevent them from falling into the hands of outsiders. Every business agent should try to send at least one man from his local to cover this work. If this is done the army will not only have expertly trained men in charge of its projection work and equipment, but the organized craft will protect itself against that day when the industry would be flooded with newcomers to the field.*

● Top this if you can. Harry Burgess, member of Syracuse, N. Y., Local No. 376, and projectionist at the Regent Theatre, is the father of five sons, all of them doing their bit for the war effort. One of the boys is serving in the Far East with the tank corps; another is with the ferry command; a third is a pilot in our air force, waiting for orders to leave our shores (maybe he has already left); a fourth son works in a defense plant; and the fifth is a pilot with the American Air Lines. Congratulations, Burgess, we hope the boys all return home covered with glory and honor.

● Howard O'Laughlin and Jim Manion, members of Local 143, St. Louis, Mo., partners in the projection room of Loew's Theatre in that city, recently came in for a good bit of publicity. The St. Louis Globe-Democrat ran a feature article entitled "What Goes On In a Projection Room," which was based on an interview given one of its reporters by the Messrs. O'Laughlin and Manion.

(*Continued on page 20*)

Notables Gather to Honor Richard F. Walsh

NOTABLES of the political world and leaders of the motion picture industry joined in praise of Richard F. Walsh, President of the I.A.T.S.E., at a testimonial dinner held in Walsh's honor in the huge ballroom of the St. George Hotel, Brooklyn. Among the 1,300 persons present were John J. Bennett, Democratic candidate for governor of New York State; Charles Poletti, the present Lieutenant Governor of New York, and representatives of the motion picture industry, including Barney Balaban, Spyros Skouras, Joseph Bernard, J. J. Shubert and M. C. Michel. Vice President Matthew Woll of the A.F.L. was among the many representatives of organized labor who attended to honor Walsh.

Typifying the attitude of many speakers were the words of Major Leslie E. Thompson of RKO. "Walsh," Thompson said, "is the sort of negotiator the industry not only wants but needs."

Gubernatorial candidate Bennett declared "Walsh is helping to make people conscious of the need of organized labor in this country."

The dinner was arranged by Walsh's own local union, Local No. 4 of Brooklyn. Thomas Murtha, business agent of the local, was chairman of the committee in charge of the testimonial.

Among the highlights of the evening was the address of former mayor James J. Walker, whose high praise of Walsh, and of the I.A., and of the motion picture industry, held the diners spellbound.

John Q. Member of practically every local of the Alliance attended the dinner to Walsh. Labor personalities present, in addition to Woll, included:

Jim Quinn, Secretary of Central Trades and Labor Council; E. W. Edwards, Secretary-Treasurer of the New York State Federation of Labor; Fred Raoul, Assistant President of the I.A.; Joe Ryan of the Longshoremen's Union; Lou Krouse, Secretary-Treasurer of the I.A.; Bill Scanlon, R. E. Morris and George Brayfield, Trustees of the I.A.; Joe Fitzgerald, Eddie Miller, Frank Stickling, Joe Basson, Steve Newman, Lawrence Katz, and Orin M. Jacobson, I. A. representatives; Carl Cooper, Felix Snow, Roger Kennedy, Jimmie Brennan, Floyd Billingsley, Bill Covert and Harry Holmden, I.A. vice presidents; Tom Green and Eddie Brock, delegates to the A. F. of L.; Eddie Canavan of the Musicians' Union; Moe Rosen, of the State Federation of Labor; Barney Ryan, formerly president, formerly business agent of Local No. 4 and formerly trustee of the I.A., the oldest living I.A. member present, who was secretary of the N.A.T.S.E., before it became the I.A.T.S.E., in 1894; Marty Lacey of the Teamsters Union, and Tom Lyons, President of the New York State Federation of Labor.

Also Morton Bramson of the I.A. office; Thad Barrows and Jimmie Burke, president and business representative, respectively, of Boston Local No. 182. Representing New York Local No. 306 were Herman Gelber, president; Herman Boritz, vice president; Charlie Beckman, financial secretary; Nat Doragoff, recording secretary; Jimmie Ambrosio, Pinkie Herbst, Abe Horowitz, Arthur Costigan, Ernie Lang, Sam Salvino, Izzy Schwartz, Mike Springer, Ben Stern, Eddie Stewart and Sam Kaplan, members of the Executive Board; as well as Jack Teitler, Brooklyn business agent and Morris Kravitz, New York business agent. Jack Winick President of the Masonic clubs of the State of New York, a member of 306, attended in a dual capacity.

Other labor lights included Harry Brooks, of Troy, N. Y.; George Cushing of Elizabeth, N. J.; Paul Ferry, Luther Thompson, Roy Grove, and a delegation of 17, from Pittsburgh; Danny Gill, Charlie Schaffer, Owen Kavanagh, Bert Ryde and Ben Pinzel of Buffalo; Louis Kaufman and Harry Oppenheimer of Newark, N. J.; Glenn Humphrey and Donald Rood of Utica, N. Y.; Sam Isaacson of Baltimore; Horace Johns, Harry Abbot, Baker Freeman and Willie Friedman of Philadelphia; Frank Kinsora of Detroit; Arthur Martens, Joe Monaco, Nathan Storch, Dick Hayes and Will Brickman of Westchester County, N. Y.; Mike Mungovan of Rochester, N. Y.; Bill Nagengast of Nassau County, N. Y.; Fred Newcomb of Providence, R. I.; Frank Olsen, Robert Burns, John Smith, Les Abbott, Larry Strong, Clarence Jalas, and E. G. Sweeney of Chicago; Morrie Seamon of the Treasurers' Union; Al Johnstone of New Orleans; Cy Braunstein of the Film Editors' Guild.

New York City stage hands were represented by Joe Dwyer, president, John Garvey, treasurer; Vincent Jacobi and Sol Pernick, business agents; Harold Williams, John McDowell, secretary; Bernie Quatrochi, member of the Board; Gus Durkin, and Lou Lapidus.

Projection supervisors included Harry Rubin of Paramount, Lester Isaac and M. D. O'Brien, his assistant, of Loew's; and Charlie Horstman of RKO.

P. A. McGuire of the International Projector Corporation, and Ed Cahill, W. L. Jones and W. W. Jones of RCA, were among those representing major manufacturers.

Richard F. Walsh

Industry leaders included Nicholas Schenck, president of M-G-M; Harry Kalmine, assistant general manager of Warner Brothers; Bill Rogers, general sales manager of M-G-M; Bob Weitman, managing director of the Paramount Theatre, New York City; Frank Phelps, labor negotiator for Warner Brothers.

Among leaders of the political world who attended were: Henry Epstein, solicitor general of New York State; Michael F. Walsh, Secretary of State for New York; Father John P. Boland, labor negotiator for the State of New York; and Congressman William T. Schulte, of Indiana, also member of Hammond, Ind., Local No. 133.

H.S.

HERE'S WHAT YOU DO WITH COPPER DRIPPINGS

The question of what to do with salvaged copper drippings has now been settled. They are to be turned over to supply dealers, sound service inspectors, or to film-delivering agencies.

Christopher J. Dunphy, chief of the amusements section of the War Production Board, announced this solution after conferences with representatives of National Theatre Supply Company, The Theatre Equipment Dealers' Protective Association and Altec Service Corporation. The collecting organizations, in turn, will dispose of the salvaged copper to registered junk dealers. The price paid by the junk dealers will go to the local Red Cross.

INSURANCE FOR PART-TIME WORK

New York State will begin paying insurance for partial unemployment on November 30th. Persons working less than four days a week, and earning less than $24.00 a week, will be elgible for the benefits, provided they report regularly to public employment offices as instructed.

BAUSCH & LOMB AGAIN HONORED

Bausch & Lomb was honored by the armed forces for the third time within 14 months when the Army-Navy "E" was presented to President Herbert Eisenhart, representing the company, and Michael J. Smith, representing the employes. In making the presentation Col. Frank J. Atwood, chief of the Rochester Ordnance District, said: "The Army is proud of its association with the craftsmen of Bausch & Lomb."

The company previously had been awarded the Navy E, and the Navy burgee with an added service star.

TELEVISION FILM TELEVISED

A motion picture telling the story of television, prepared by General Electric Company, is now available for presentation at schools, service clubs and for other audiences that may be interested. It offers a complete backstage picture of how a television program is presented. The first public showing of the film was by television, over General Electric's station WRGB.

U. S. ARMY NOW HAS WORLD'S LARGEST 'THEATRE CIRCUIT'

The largest "theatre circuit" in the world is that now operated by the U. S. Army Motion Picture Service, the Atlantic Coast Section of the Society of Motion Picture Engineers will be told at its forthcoming meeting.

Mr. R. B. Murray, Director of the Army's Motion Picture Service, will present a paper describing in detail the organization, staffing, financing and operation of exhibition of motion pictures by and for the Army.

All who are interested are invited to attend. Admission cards can be obtained by communicating with Dr. Alfred N. Goldsmith, Society of Motion Picture Engineers, Hotel Pennsylvania, New York City. The meeting will be held at the Hotel Pennsylvania, opening at 8:30 P.M., on November 19th.

BELL & HOWELL WINS "E"

The Army-Navy "E" has been awarded to Bell & Howell for outstanding war work. Employes of the company are now entitled to wear "E" pins. The company's manufacturing facilities have been almost entirely converted to war production.

KELLEY HEADS RESEARCH COUNCIL

William F. Kelley has been appointed manager of the Research Council of the Academy of Motion Picture Arts and Sciences, replacing Gordon Mitchell, who is now on active duty with the Signal Corps with the rank of captain. Kelley has been Mitchell's assistant for the past seven years. Kelley was appointed by Colonel Darryl Zanuck, Chairman of the Council.

SIMONS OF ALTEC HELPS NAVY

W. W. Simons, of the engineering staff of Altec Service, has been transferred to the newly formed Electronic Division, at Lexington, Mass., where an electronic device, whose nature is a military secret, is being manufactured by Altec for the U. S. Navy.

WANTED FOR THE PANAMA CANAL: MOTION PICTURE OPERATORS, with at least 3 years experience. Salary $175 month. Must be capable of operating standard 35 mm. sound motion picture equipment, act as chief operator and make repairs ordinarily expected of a chief operator. Must be male American citizens, physically sound, and preferably under 45 years of age. Free transportation by plane from Brownsville, Texas, wages beginning date of departure from United States; also $5 per diem allowance from time of departure from home address until time of departure from States, and railroad transportation from home to Brownsville. Appointees must go to Isthmus alone. Bachelor quarters at reasonable rates available upon arrival. For particulars write "Chief of Office, The Panama Canal, Washington, D. C.," giving brief statement of training and experience.

EASTMAN KODAK PUBLISHES NEW MOTION PICTURE FILM BOOK

The concentrated result of many years of research and practical experience is packed into Eastman Kodak Company's newly published book: "Eastman Motion Picture Films for Professional Use."

Innumerable details of motion picture photography are covered; tersely, adequately, and with lavish use of graphs and photographs to convey information more compactly than words ever could. An astonishing amount of factual material is presented on almost every page.

The H&D curve, the use of gamma in development, basic considerations of sensitivity, exposure, graininess and resolving power are reviewed. Filters are discussed with the aid of graphs that reveal the performance of each type at a glance. Developing, fixing and hardening solutions are given, and related to conditions of optimum temperature. A special chapter deals with packing, handling and processing motion picture film in tropical regions.

The book totals 80 pages; its compactness being such that the information included is as extensive as one might expect to find in a much bulkier volume. It is very attractively made, bound in stiff covers treated with an enamel-like Eastman preparation that resists soiling, finger marks and moisture. Price is $2.00; copies are obtainable from the Motion Picture Film Department of Eastman Kodak Company.

S.M.P.E. ELECTS GRIFFIN

(*Continued from page 9*)

Carver. These discussed the effect of high temperatures on 35 mm film and the effect of film distortion on projection quality. High speed 16 mm motion pictures were taken of the action of 35 mm film in a regular projector aperture. These high speed pictures, projected at the convention, showed photographically that 35 mm frames are not at rest in the aperture. They vibrate, and occupy their proper focal plane only for a short fraction of the total time of exposure.

This motion of film in the aperture appeared to be related to the use of high temperature light sources, since at low aperture temperatures it does not occur. Dr. Carver inclined to believe that the effect is produced by a certain drying of the emulsion under the sudden, intense heat of the projection light. Members of the audience with long experience in projector repair work offered a confirmation of Dr. Carver's findings that was a surprise to the speaker; they told him that old projector gates and apertures show signs of wear which indicate that film passing through them behaved just as Dr. Carver's high speed movies indicated.

The war and matters related to it was perhaps the dominant note of the three-day meeting. One evening of the three was spent by members at the Signal Corps Photograph Center in Astoria, L. I. Many papers relating to war uses of motion pictures by the armed forces, and by the governments of Russia and China, were presented, and Chinese propaganda films were shown and heartily applauded.

Officers of the Society chosen with Griffin and Ryder included Arthur C. Downes and William C. Kunzsmann, both of National Carbon Company, who were re-elected editorial vice president and convention vice president, respectively. Other officers-elect of the Society are E. Allan Williford, National Carbon Company, secretary; M. R. Boyer, E. I. duPont de Nemours & Co., Parlin, N. J., treasurer; William A. Mueller, Warner Brothers, First National Pictures, governor; and H. W. Remershied, Bell & Howell Co., governor.

PROJECTIONIST WANTED

Minor trouble developed in a 16-mm sound projector which was presenting a Chinese government propaganda picture at the recent convention of the Society of Motion Picture Engineers. While adjustments were being made in the darkened auditorium some two hundred of America's crack motion picture technicians heard a facetious engineer call out: "Is there a projectionist in the house?"

WOMAN PROJECTIONIST BURNED TO DEATH

Joyce Arline Madsen, aged 22, was burned to death while training to take her brother's post as projectionist at the Royal Theatre, Bentonville, Arkansas. Although her two brothers, Lyle, whom the young lady planned to replace, and Keith Madsen, were in the projection room at the time, they could not save her. Lyle was badly burned about the face, hands and arms in trying to help his sister.

It is not clear how the accident happened. The young lady was rewinding a reel when, according to available accounts, the film "jumped from the machine, fell at her feet and exploded, catching fire to her clothing." Both projectors were destroyed by the blaze, which was, however, confined to the projection room.

NEW STRONG "V" LAMP PLACED UNDER PRIORITY

The one-kilowatt "V" lamp recently designed by Strong Electric Company, of Toledo, Ohio, although containing a minimum of critical materials, has been placed under priority restrictions.

The Strong "V" lamp, rated at 40-43 amperes, 27-28 volts, is of the one-kilowatt high intensity type, using 6 mm negative and 7 mm positive carbons. It embodies a minimum of such strategic substances as aluminum, copper and brass, being made mostly of sheet metal with some cast iron parts. None the less, it can now be obtained only under a higher priority rating than is usually granted to theatres.

The Strong company is maintaining a parts and service department to help theatres take care of requirements of their existing equipment, and solve difficulties resulting from present restrictions.

IN THE SPOTLIGHT

(*Continued from page* 15)

● Organized labor was first in this land of ours to condemn Hitler, clamp a boycott on all Nazi merchandise, and condemn Japanese aggression in China. It refused at one time to load the ships (laden with the scrap we need so much now) sailing for Japan. Labor is in this war to end all wars so that free men may work in peace.

● Max Munch was very much in evidence at the S. M. P. E. convention hall. His splicing machine and contact jaw contraption aroused a great deal of interest among the dealers present, and it looks as though Max will do a land office business with his devices. We forgot to mention in our last issue that all communications regarding these products should be addressed to the Master Specialty Products, 200 West 72nd Street, New York City.

● Many of our I. A. members are officers in civic and fraternal organizations, but few ever win the distinction of being chosen Master of a Masonic Lodge. However, Frank Higgins, member of Rochester, N. Y., Local No. 253, is one of the lucky few. He is now the Junior Warden of the Orpheus Lodge in Rochester, and will shortly be installed as Master. As a Past Master myself, I should like to be present at your installation, Frank. Yes, this is an open bid for an invitation.

● An exhibitor in a certain town in Wisconsin claims that he is unable to get projectionists for his theatres, "because," he says, "so many have gone into the army and navy." We happen to know this particular exhibitor personally, and we also know just what he pays his projectionists. He would not find a labor shortage at the present time if he would pay his projectionists a decent wage, but at the low scale in effect in his theatres he will always have a labor shortage, war or no war. There is no shortage of manpower in the organized craft—if one local union happens to be short of men it can always call upon its sister local union to help it out.

● If you have in your possession movies or still pictures of railroads, industrial centers, or harbor installations of any of the Axis countries, or if you know of anyone who might have them, get in touch with Colonel William J. Donovan, United States Office of Strategic Services, 1600 Broadway, New York City. These pictures are needed at once.

I. P. CONTEST

(*Continued from page* 10)

or bought and keep on hand for just such occurrences. A number of others described ways of modifying their existing apparatus, sometimes with the aid of a part or two left behind from some previously installed system, whereby the difficulty in question could be overcome.

Following is a part of the answer submitted by James W. Tarr, first prize winner:

"I have a very versatile power supply kit which contains a wide variety of filament and plate voltages. It is so arranged that these various voltages terminate in coded tip jacks and are instantly available. This device provides both AC and rectified and filtered DC, thereby making it possible to tap in anywhere in the amplifier in use. If the transformer were the only part that was faulty I would use the high voltage AC supply from the substitution box and utilize the regular rectifier and filter sections of the amplifier. But if the rectifier and filtering sections were faulty I could cut them out entirely and use the DC high voltage supply from the substitution box. Inasmuch as this gadget was designed with considerable allowance for overloading, it can be used as long as necessary without damage to itself or to the system. This device, which I made for myself, has saved the day for me more than once."

Second prize winner Maurice Rushworth might possibly have been voted first prize winner except for one little slip in his closely-written three-page letter. At the very end of a detailed account of terminal strip numbers, wire color codes, and so on, in his projection room amplifier Rushworth specified one single connection in a way that is dubious and could be interpreted as incorrect. All the rest of his letter, however, shows that he would not in practice have made an incorrect connection. This contestant writes:

"I have assumed that the power transformer burns out . . . after all radio and other stores are closed, and also that the material and tools available are a screwdriver, a pair of pliers and some old lamp cord."

Rushworth goes on to explain that he has the Western Electric 86-type amplifier diagrammed on page 13 of I.P. for April, 1942, an AC Jensen-W.E. woofer speaker for monitor, an unused TA 7276 (12 volt) rectifier unit and large projection room ports with no glass. Since the monitor speaker is not strictly necessary, he will dispense with it and use its field supply circuit, which is powered by a Western Electric 274 rectifier tube, as a source of plate supply for his amplifier; and he will use the old low voltage power supply unit (TA 7276) to heat the amplifier filaments. In describing how he would connect these substitute power sources Rushworth not only lists the number of every terminal post, and the color of every wire, that would be changed or affected (it should be added that I.P. checked up every one of these); but he also goes into just how the work would be done to save time—how he would perform one operation while his partner worked at another—and how they would double-check the job and improve it in small details after the show.

Third prize winner Francis L. Hill writes:

"Amplifier system is Western Electric Mirrophonic, consisting of 86-C amplifier and 87-C power amplifier. A switch is provided to cut out the final amplifier and operate on the 86-C in case of failure of the 87-C power amplifier.

"For the purpose of this problem, we will assume that the T4 power transformer in the 86 amplifier has burned out." (If the transformer in the 87 had gone, Hill would have no problem; he'd merely throw that switch.)

"As the system will operate without the power amplifier, the logical answer is to obtain power for the 86 from the transformers of the 87, and run on the 86 alone."

Hill then goes on, like Rushworth, through a page and a half of closely spaced typing, to specify wire colors and terminal post numbers in full. His letter falls short of Rushworth's only in that he leaves a single item of detail to be determined at the time "by experiment" instead of working out the answer as part of this problem.

Ed. Howson, first of those to be awarded a year's subscription to I.P., submits a solu-

(*Continued on page* 22)

I. P. CONTEST

(*Continued from page 21*)

tion almost identical with that of first prize winner Tarr, from which it differs only in being less comprehensive.

M. J. Nederostek, who also wins a year's subscription, writes:

"I have made arrangements with four different individuals . . . who own amateur transmitting stations. Since these stations have been silenced by the Federal Communications Commission for the duration of the war, they are all idle at present. I have selected the four particular stations because their power supplies have power transformers that give the exact filament and plate voltages required by my theatre amplifier. One of those amateurs has been persuaded to change his connections so that by loosening one connection strip, the entire unit can be removed from his rack in less than a minute. All four of these men have telephones and one of them is certainly to be found on the premises should we need him . . . and can bring the unit in, or we can get it while the burned-out unit is being removed. I estimate that the whole operation can be carried out in 15 minutes . . ."

Robert E. Coble, likewise winner of a year's subscription, also has an emergency power pack on hand.

C. H. Perry diagrams a perfectly practicable method of using two wires of a 550-volt three-phase A.C. power supply for plate power for his particular amplifier.

Alanson M. Kittredge sends six pages of accurate descriptive detail, and two pages of wiring diagrams, explaining how to use old radio transformers in combination, to serve in his theatre amplifier.

H. D. Taylor suggests several alternative methods, including the use of radio transformers and radios themselves, a voltage doubler circuit; and operating his amplifier at less than normal voltage (but still acceptably for emergency purposes) by rectifying a 230-volt a.c. supply line.

I.P. regrets its inability to print the contest answers in full. If that could be done, a reading of those answers would convince anyone that projectionists are on their toes, and very wide awake to the requirements of the present time.

Contest in Wartime Projection

A Test of Skill and Wits

KNOWLEDGE of projection, skill, and resourcefulness in meeting unusual conditions arising out of the war feature this novel contest, which is open to all practicing projectionists. Fancy writing, skill of presentation, win no prizes; prizes are awarded solely on the basis of how well the contestant has met the problem presented. The editorial staff of I.P. are the sole judges, and their decisions are final.

The following prizes are offered *each month*:

First Prize . . . . ***$10.00* in War Stamps**
Second and Third Prizes . . . . ***$5.00* in War Stamps**
Next Six Best Answers. . One Year's Paid-up Subscription to I.P.

Additionally, at the end of the contest, there will be awarded for the most consistent showing a

Grand Prize . . . . ***A $25.00* War Bond**

All answers must reach this office by the tenth day of the month following publication of the question: that is, all answers to November's question, published below, must reach I.P. by December 10.

Here is the question for November:

A coupling transformer in your amplifier system breaks down, stopping sound. Because of war conditions you can't get another one for some weeks. Your theatre has no emergency amplifier. What do you do?

Apply this question to your own equipment, your own projection room. It's your problem, you have to solve it; there'll be no show till it's solved.

For the most ingenious and *practical* solution you win $10.00 in war stamps and a running start toward the Grand Prize $25.00 war bond.

William J. Lehle, Eastman Kodak machinist, and Thomas J. Hargrave, president of the Company, accept the Army-Navy Production Award pennant.

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INTERNATIONAL

PROJECTIONIST

DECEMBER 1942

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With Which is Combined PROJECTION ENGINEERING

***Edited by* Aaron Nadell**

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Monthly Chat

THE SHOW will go on, war or no war—that is evident to anyone who has noted the magnificent response to I.P.'s current contest. Let the power transformer burn out, or the main drive gear strip—the craft will keep the show going one way or another. Nothing short of a government order can stop the projectionist.

• • •

Still, transformers don't burn out for no reason; neither—as a number of contestants point out this month—do main drive gears strip without reason. The fact that their projectionists may be resourceful enough to cope with even such troubles successfully is no reason for the management to invite trouble by refusing to authorize timely inspections.

We have touched on this subject before, and will probably refer to it again. Mechanical or electrical breakdowns don't just happen. They occur for definite reasons. Frequent and thorough inspections can disclose reasons for expecting trouble, if such exist, and necessary remedies can be applied in time to forestall an emergency.

For the duration, management will fall short of its obligation if it does not authorize and pay for equipment inspections after hours, on a scale not followed nor needed under ordinary conditions. That is one of the first necessities of wartime operation.

• • •

Projectionist Charles Butler of New York City had the right idea when he suggested salvaging those old motion picture prints—Bingo reels, special programs, and the like—which clutter the top shelves of so many projection rooms. Mark S. Asch, technical director of the Bureau of Motion Pictures of the OWI, tells I.P. the government wants this done—and urgently. The old films will not be made into ammunition, but they will be converted into other war necessities, thereby freeing chemically pure raw materials for making explosives.

Old film should be turned over to an exchange, according to D. E. Hyndman, Engineering Vice President of Eastman Kodak Company. The exchange will get 9-9½ cents a pound for it, but in consideration of that price must ship the film to a conversion plant in an approved, fire-resisting container. With this information, a theatre with any appreciable quantity of old film around should be able to make a suitable deal with the exchange.

• • •

To all our readers and friends—Merry Christmas and a Happy New Year.

A. N.

INTERNATIONAL PROJECTIONIST

VOLUME XVII DECEMBER 1942 NUMBER 12

Analyzing Amplifier Diagrams

III.

By LEROY CHADBOURNE

Showing how complex diagrams of theatre amplifiers can be analyzed into a large number of simple circuits, each of which can be treated individually.

Like the other diagrams published in this series the schematic of a theatre amplifier here reproduced as Figure 1 can be resolved into a number of simple circuits, each of which consists of a source, two connecting wires, and a load. As with the schematics previously examined, it is not necessary to study the entire diagram in order to obtain essential information concerning some given circuit in which trouble is experienced or a change is desired. Any of the many circuits composing this drawing can be traced individually, as if it constituted an indepedent unit.

In addition, Fig. 1, representing a theatre amplifier of the SOS Corporation, exemplifies a point of special practical importance to the projectionist—namely, that different draftsmen draw the same electrical parts in different ways. For example, note the 6 SF 5 tube—the input tube. The cathode is drawn as a segment of a rectangle, on the same vertical level with the grid and plate. This method of representation is not common, but neither is it rare. Again, the 6 N 7 tube, the next stage, is drawn with two grids, two plates and only one cathode. This is entirely acceptable, since the tube has only one cathode prong. The heater of the 6 N 7 is not shown at all, although one is indicated in the case of the 6 SF 5. No heaters are shown for the 6 L 6 tubes, or for the 6 F 6, although of course those tubes have heaters.

The heaters of all the amplifying tubes of this circuit are of the 6 volt type, as shown by the fact that all tube designations begin with the figure 6. A glance at the power transformer at the bottom of the drawing shows that its extreme left-hand secondary is drawn as open-circuited. and there is no other secondary from which heater current for the amplifying tubes could be drawn. This extreme left-hand secondary must, therefore, be the one that supplies the amplifying heaters.

In other ways also this diagram departs from the methods of draftsmanship with which projectionists are most familiar, and approaches more nearly styles of electrical draftsmanship widely used in related industires. Note the way the cathodes and screen grids of the 6 L 6 and 6 F 6 tubes are represented. The projectionist should accustom himself to such variations in drawings.

If he encounters a variation new to him a little common sense, plus reference to the physical apparatus if necessary, will clear up all minor puzzles, and drafting methods do not vary enormously. As a case in point, note the jacks for microphone and disc input at the top of the diagram, just right of and above the 6 SF 5 tube. There is only one connection to these jacks (running to the upper grid of the 6 N 7). But any circuit must have two wires. There must be a second connection to ground. Reference to the physical apparatus, if necessary will show that these jack frames are solidly mounted in the chassis, and further that the chassis is used as the ground bus of this amplifier. The drawing in fact, with ground connections scattered everywhere through it, in itself indicates strongly that the amplifier chassis is the common ground.

One further glance at this diagram will facilitate locating and tracing its individual circuits. Just above the 5 Z 3 rectifier tube is a line that runs all across the drawing from left to right. At its right hand end it is designated as a maroon-colored wire. This long line appears to be common to many circuits, in other words, it may be regarded as a "bus" of some kind. Since the chassis itself is the negative or ground bus this long line may represent the common source of positive B power.

Checking this possibility, it is readily seen that the center-tap of the rectifier filament secondary of the power trans-

former, which of course is the positive B source, can be traced up to the first connection, right through a red wire to the terminals leading to the monitor speaker field, and thence back to this same "maroon" line. Obviously, that line in fact is the common B positive bus, the monitor speaker field serving as a filter choke. This is confirmed, if confirmation were needed, by noting that two 8-mfd capacitors (built in a single unit as a "double" condenser) are connected directly across the monitor field circuit, and assist the filtering action.

With the chassis of the amplifier established as the negative B common, and this long, horizontal line as the positive B common, any of the individual B circuits can be traced without the slightest difficulty. Two source terminals have been established. Consider the B circuit of any tube, the 6 SF 5 for example. The load terminals are the plate and cathode contacts of the socket of that tube. From the plate terminal trace directly downward through two 200,000 ohm resistors to the positive source. From the cathode trace directly downward to ground. That is all there is to the B circuit of the 6 SF 5.

The 6 N 7 has two B circuits, the cathode being the common negative of both. From cathode trace down, and left through 2,000 ohms to ground. From the lower plate (the phase-inverter section) trace straight down through 200,000 ohms to the positive source. From the upper plate trace right, down, left through 200,000 ohms, and down through 200,000 ohms to the positive source.

Tracing from the plates of the 6 L 6 tubes, through the center-tap of the primary winding of the output transformer, shows that these tubes do not derive their plate power from the line that has been filtered by the monitor speaker field, but directly from the ultimate positive source, the center-tap of the rectifier filament secondary of the power transformer. This is readily seen by tracing straight down from the center-tap of the output transformer. The negative side of this circuit may be traced from the line linking the two 6 L 6 cathodes, trace left down through 250 ohms, and left to ground.

Grid Bias Circuits

The screen grid circuits of the 6 L 6 tubes, however, have for their source the secondary distribution line, the common B positive bus of this drawing. From those screen grids, shown surrounding the bottom of each plate, trace straight down. The negative side of the screen grid circuit is, of course, the cathode circuit of the same tubes.

The plate and screen grid circuits of the 6 F 6 monitor amplifier tube are wired wholly in parallel to the corresponding circuits of the 6 L 6 tubes.

To trace the grid bias circuits of Fig. 1 it is necessary to look for the grid bias resistors in the cathode lines of the amplifier tubes. Regard the two ends of each such resistor as the source terminals of bias voltage, and the control grid and cathode of each tube as the load terminals for the bias voltage. The cathode line of the 6 FS 5 input tube shows no bias resistor. The cathode is connected directly to ground. Therefore there is no grid bias circuit for that tube; the grid operates at zero bias; but it will be noted that the grid leak of the 6 FS 5 is given the unusually high value of 15 megohms.

From the cathode of the 6 N 7 trace to ground through 2,000 ohms. All the plate current flowing through both sections of this tube must complete its path to negative through that resistor. The corresponding voltage drop through that resistor is the source of grid bias. The upper grid is connected to the negative voltage source through the 250,000 ohm volume control; the lower grid is tied to the same source through 10,000 ohms. The cathode, which is the positive load terminal of the grid bias circuit, is joined to the positive side of the source.

The grid bias circuit of the 6 F 6 monitor amplifier tube is wired wholly in parellel to the grid bias circuit of the two 6 L 6 power tubes. That the positive leg, the cathode line, is common to all three tubes, has already been noted. In that line is a 250 ohm resistor, through which flows the plate current of all three tubes. The voltage drop across that resistor is the source of grid bias voltage for all three tubes. The negative side of that resistor is grounded. And the grids of all three tubes are also grounded (through suitable grid leaks).

From the grid of the lower 6 L 6 trace straight down through 100,000 ohms to ground. From the grid of the upper 6 L 6 trace left, down through 200,000 ohms, left through 10,000 ohms, and down to ground. There is no difficulty about tracing these lines. The negative side of the grid bias resistor in the cathode line is grounded; therefore the grids must connect to ground, and it is only necessary to start at each grid and trace back.

The amount of resistance in the grid leaks makes no difference so far as grid bias is concerned, because there is no grid bias current. The grid, being kept negative by the grid bias, repels electrons, and the grid bias circuits are always open at the grids. Thus, there is bias voltage, but no such thing as bias current. Since there is no grid bias current flow in the grid leaks, there is no grid bias voltage drop across those resistors, and their value does not in any way change the amount of bias voltage on the grids of the tubes. That voltage is determined solely by the drop across the grid bias resistor in series with the cathode.

Speech current, however, flows as a.c. in the grid bias resistors, and the values assigned to them govern speech volume, and to some extent, frequency response.

Four speech input circuits are provided in this amplifier. No. 1 terminal, at the extreme top left of the drawing, is one side of the input from No. 1 photocell, which runs right through a .004 mfd. condenser, and down and right to the grid of the input tube. One side of the input from No. 2 photocell enters at No. 2 terminal in the upper left-hand corner of the drawing and runs straight right through a condenser to the same grid. The other side of both circuits is common, the shields of the input cables which, of course, are grounded to the amplifier chassis, and therefore to the cathode of the 6 SF 5.

Speech Circuits of Fig. 1

Taking the plate and cathode terminals of the 6 SF 5 as the source terminals of that tube's plate speech circuit, the 200,000 ohm plate resistor may be regarded as the load, with the .5 mfd. condenser in series with one leg of the line. A branch circuit exists, of course. From the plate trace right through .01 mfd., down through the volume control to ground, and from ground back to the 6 SF 5 cathode.

That portion of the volume control which lies between the arrowhead and ground may be regarded as the source of the speech grid circuit of the upper section of the 6 N 7; the load being the cathode and upper grid of that tube. The arrowhead connects directly to the upper grid; the cathode ties to ground through a 2,000 ohm resistor which is in series with one leg of the line.

Cathode and upper plate of the 6 N 7 may be taken as the source of the plate speech circuit of the upper section of that tube. The 200,000 ohm plate resistor may be considered the load. The plate connects (trace down and right) to the right hand end of that resistor. Its left-hand end connects left, through .5 mfd. to ground; while the cathode of the tube connects down, left through 2,000 ohms, to ground.

There are two branch circuits. One may be traced from the plate right through .01 mfd. to the upper end of the 250,000 ohm tone control rheostat; thence down through 0.1 mfd. to ground. The other may be traced right through .01 mfd., down through 200,000 ohms, and left to ground through 10,000 ohms. The voltage drop across that 10,000 ohm resistor may be regarded as the source

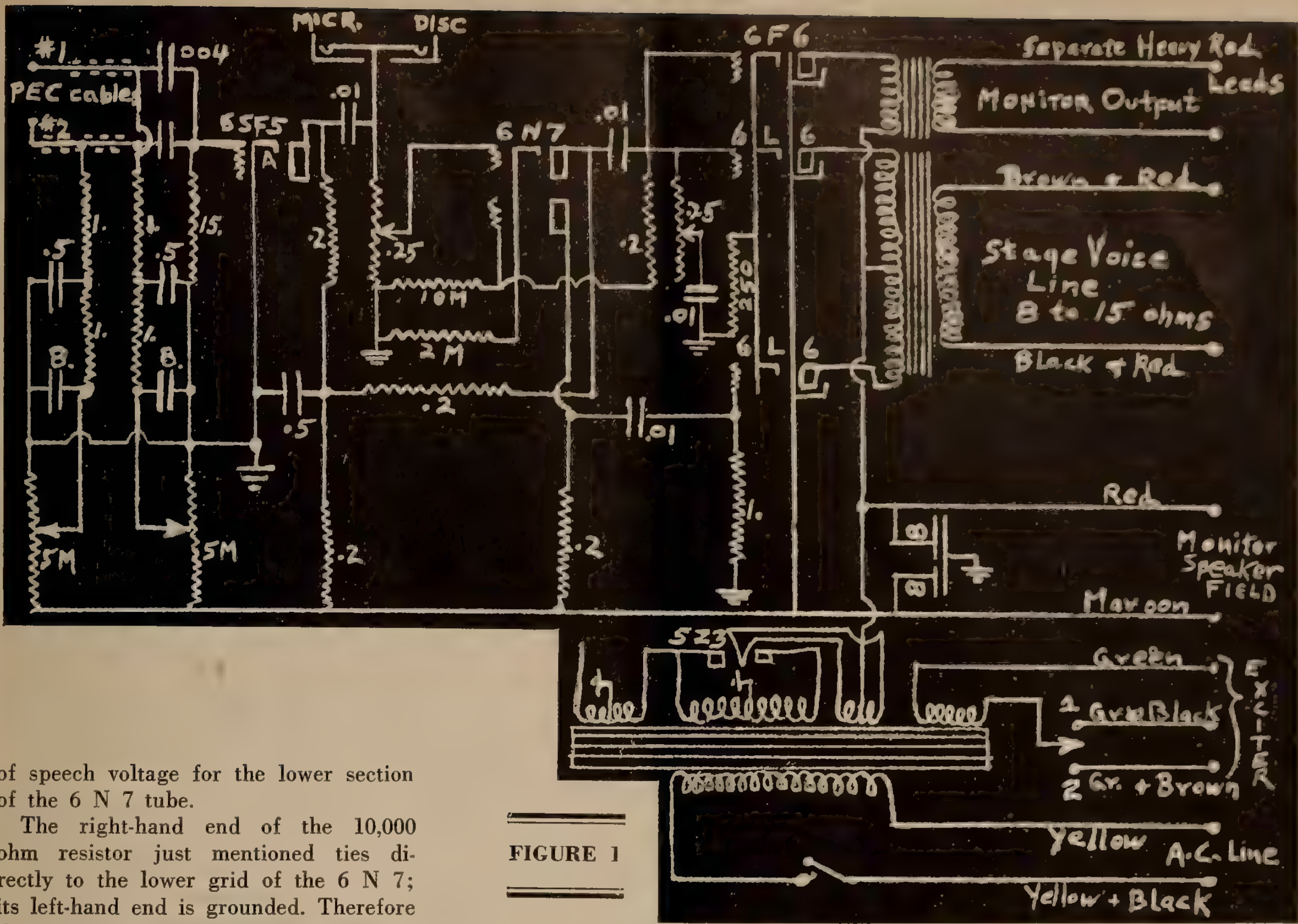


FIGURE 1

of speech voltage for the lower section of the 6 N 7 tube.

The right-hand end of the 10,000 ohm resistor just mentioned ties directly to the lower grid of the 6 N 7; its left-hand end is grounded. Therefore this resistor, regarded as a source of voltage, is connected directly across grid and cathode of the lower section of the 6 N 7.

The cathode and lower plate of the 6 N 7 being considered the source terminals of the plate speech circuit of the lower section of that tube, trace from the plate straight down through 200,000 ohms to the positive B bus, and right, up, and through 8 mfd. to ground. The cathode of the same tube has already been repeatedly traced to ground (and although drawn in association with the upper section only, the cathode in fact is common, as said, to both sections; or to be more accurate there are two cathodes, in parallel, with only one external cathode prong).

A branch circuit runs from the lower 6 N 7 plate down, right through .01 mfd., and down through 100,000 ohms to ground. The speech current flowing through that 100,000 ohms corresponds to a voltage drop through that resistor, which voltage drop is connected directly across grid and ground of the lower 6 L 6 tube, constituting the speech input source for that tube.

The speech input source for the upper 6 L 6 tube is found in that branch of the plate speech circuit of the upper 6 N 7 section which has already been traced through the 250,000 ohm tone control rheostat and .01 mfd. to ground. The voltage drop appearing between the top of that resistor and ground represents the source of speech input for the upper 6 L 6.

Those projectionists who may not be thoroughly familiar with this type of push-pull arrangement, in which phase inversion takes the place of a coupling transformer to the push-pull stage, will note that the upper section of the 6 N 7 derives its speech input ultimately from the output of the 6 FS 5; and the upper 6 L 6 tube derives its speech input ultimately from the speech output of the upper section of the 6 N 7. But the upper section of the 6 N 7 also supplies speech input for the lower section of the same tube, and the lower 6 L 6 is driven by the lower section of the 6 N 7. Thus there is one additional stage of amplification added to the speech supply to the lower 6 L 6, putting the two 6 L 6 tubes 180 degrees out of phase with respect to their speech currents. Thus the two output tubes work in push-pull, not in parallel.

Both operate at the same volume, however, because the volume increase deriving from the additional amplification is cancelled. From the upper plate of the 6 N 7 trace right through .01 mfd., down through 200,000 ohms and right to ground through 10,000 ohms. There is a total of 210,000 ohms in this line, and only the voltage drop across 10,000 ohms of that total is connected across grid and cathode of the lower section of the 6 N 7. Thus the speech input to the lower section of that tube is cut down to approximately the same value as the speech input to the upper section.

The reader may wish to trace for himself some other circuits of this schematic, including the speech output circuit of the 6 L 6 tubes (the return to cathode is through the 8 mfd. filter condenser), the monitor amplifier circuits and the d.c. supply to the photocells.

ALTEC INCREASES STAFF

Altec has further enlarged its staff of inspectors as a result of increased business. Latest additions to the Altec family are: J. I. Hilton, Cincinnati; J. V. Washburn, Arlington, Va., and J. C. Harper, Atlanta. Lou Taylor, formerly located at Malone, N. Y., has been transferred to Poughkeepsie, N. Y., to take over the Newburgh territory.

In accordance with its promotion-from-the-ranks policy, Altec Service has upped P. F. Thomas, formerly credit manager of the Detroit district office, to general credit manager at the New York office. F. J. Morin, of the Altec accounting department, has been promoted to the Detroit credit managership.

Role of Projectionists in the U.S. Army

Projectionists of the U. S. Army Motion Picture Service theatres are soldiers chosen by the Theatre Officer of each camp or post where the Motion Picture Service functions. Previous experience, training or skill in projection count just as far as the individual Theatre Officer chooses to take such facts into consideration, and no further.

These and many other facts concerning the role of projectionists in the army were set forth by executives of the Army Motion Picture Service at the November 19th meeting of the Atlantic Coast Section of the Society of Motion Picture Engineers. Some of the details relating to the selection and training of projectionists were brought out by questions which I.P.'s Harry Sherman asked of R. B. Murray, Director of the Service.

The commander of each camp or post, Murray explained, designates a Theatre Officer to take charge of the camp theatre. This officer's duties are those of a theatre manager, and he, in turn, selects soldiers as projectionists. His decisions are final, according to Murray. The speaker further explained that there is no attempt by the army either to enlist or to commission men on a basis of projection experience, or to assign them to any particular rating in connection with projection work. Projection work is regarded as a "pleasure time" activity unrelated to regular army duties, and may be assigned to any soldier at all who wishes to put in extra hours for extra pay ranging up to $52 a month.

A soldier who has been a projectionist in civilian life is free to ask for assignment to projection work. He may or may not get it. If he does, his services in that respect will have no connection with his official duties, rating or pay.

The men who are assigned to projection work are instructed by engineers of the Army Motion Picture Service; or, if there is no engineer at the camp at a given moment, a new man may be instructed by other projectionists of the camp's theatre. Each theatre is staffed by two projectionists and a reserve projectionist. Only very rarely does it happen, Murray declared, that all three are transferred or otherwise unavailable at the same time. In such cases a civilian engineer of the Motion Picture Service is rushed to the camp to break in new men. Murray stated, in reply to one of the questions asked by Harry Sherman, that he had no idea of the proportion of experienced to inexperienced men engaged as projectionists.

The Motion Picture Service

I.P. learns unofficially that the engineers of the Motion Picture Service seek to direct the choice of Theatre Officers toward experienced and competent men as camp projectionists; but that is all off the record and is a matter of how far the individual Theatre Officer sees fit to listen to the advice of civilian engineers.

The Army Motion Picture Service is composed of civilians, employes of the War Department. It designs, plans, builds, equips and services theatres at army camps and posts, and books pictures from producers. It does not operate the theatres. Their operation falls under the jurisdiction of the camp commander, who appoints a Theatre Officer (essentially a theatre manager) to take charge. Soldiers pay from 12c to 15c admission. The general public is not permitted to attend, and advertising of coming attractions is confined to the camp or post. The revenue obtained from admissions goes to build more theatres, to buy more equipment, and to pay more soldier-projectionists for their services. There are two projectionists and a reserve projectionist for each theatre.

The purpose of the service is to assist in sustaining morale by relieving the strain of military life and transporting the soldier for a little while to the relaxation of civilian-type surroundings. Thus, upholstered seating is provided in many of the theatres, and ushers receive the soldier-patrons with tact in place of military discipline.

Equipment is of standard commercial types, modified, however, by the engineers of the Service. Forty-three service engineers are employed at present. Chief Sound Engineer George L. Bub told the S.M.P.E. meeting that the Service developed a projector rear shutter in 1923, believed to be the first rear shutter ever put in use. Other innovations introduced by the Service's engineers included the use of arc motor-generator sets to power the fields of d.c. loud speakers; removing oil-soaked cables from the bottoms of sound motor-generator sets and replacing them with leads brought out through the tops of the end bells; installation of a fire shutter lift lever which automatically lifts the fire shutter when the film trap is opened, and development of a warble oscillator for checking auditorium acoustics.

Service problems involve some difficulties not often found in civilian theatre work, Bub noted. He cited one case of noisy reproduction which was caused by vibration of tube elements when a nearby cannon was fired. Range-finder signals

(*Continued on Page* 22)

Left to right, back row: Members of U. S. Army Motion Picture Service, M. D. Kicales, mechanical engineer; George L. Bub, chief sound engineer, and Charles Welpley, architect. Front row: Major T. J. Johnson, U.S.A.; R. B. Murray, director of the Army Motion Picture Service and Dr. Alfred N. Goldsmith.

Exhibit Teaches Science of Sound

ATTRACTING projectionists among thousands of other visitors, a free scientific exhibit put on by Sonotone Corporation at 570 Fifth Ave., New York City, provides a world of information about sound, and presents it so picturesquely it is not easily forgotten.

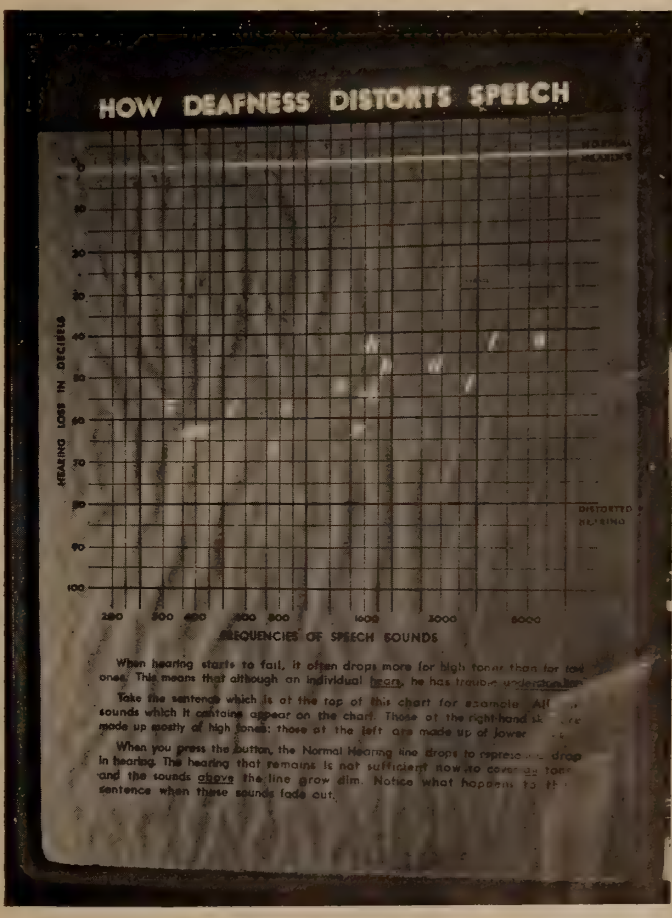
Of outstanding interest to projectionists is the chart, here reproduced, showing the actual frequencies of speech sounds. The position of "s", above 6,000 cycles, and of "f", above 4,000, indicate clearly why reproduction of these sounds provide an important clue to the high-frequency response of a sound system. The effect of loss of high frequency response is graphically illustrated when the visitor presses a button; the sentence at the top of the chart is distorted to read only: *"-OW -EA-NE— -I—OR— - -EECH"*; while the letters *h, p, d, t, f, s,* disappear from the body of the chart.

Induction trumpet—a "radioless radio".

Also of particular interest to projectionists is the little ear trumpet here shown, which represents a kind of radioless radio; for it picks up sounds without wire connection, but it does not use radio principles or radio-frequency currents. It is simply the secondary coil of an audio-frequency sound transformer, connected to a small earphone; the primary coils are hidden in the walls. As the visitor progresses through the exhibit, he puts the trumpet to his ear wherever he sees an orange light, and a little lecture comes to him from the primary coil hidden behind the wall at that point. This also is how he hears the sound of a small-screen sound motion picture.

Among other exhibits of interest there is a highly decorated panel with some vertical lines running through it, and a flashlight "pistol." A loudspeaker delivers pure tones of from 60 to 15,000 cycles, according to which vertical line the visitor chooses to illuminate. He can, incidentally, test whether his own hearing goes up to 15,000 cycles, or stops at 10,000 or less.

At other portions of the exhibit the visitor can make a recording of his own voice on a steel tape and listen back to it immediately. He sees dissected portions of the human ear, while signs and his little induction-trumpet explain the mechanism of hearing. There is also a movie short of the mechanisms of hearing, and another of the progress of ear disease. Bone conduction hearing units demonstrate that sound vibrations can easily be felt by the fingers, and can be heard, with complete intelligibility, through the nose-bone or cheek-bone or temple.



The letters h and p and all letters to the right of them disappear from this chart when a button is pressed. The sound frequency corresponding to each of these letters can be found by referring to the row of figures along the bottom of the chart.

BELL LABS WINS ARMY-NAVY "E" AND EMBLEMS FOR EMPLOYES

The Army-Navy "E" was awarded to the Bell Telephone Laboratories in a ceremony which marked, as one of the speakers said: "the first occasion . . . of an Army-Navy award to an organization which produces ideas in contra-distinction to equipment . . . in quantity manufacture."

Representing Bell Laboratories at the ceremony were Dr. F. B. Jewett, chairman of the Laboratories Board; Dr. O. E. Buckley, President; Eric Weil, Miss Eleanor L. Freeman and Franklin A. Korn, representing employes. Colonel Rex Corput of the Signal Corps spoke for the Army, Lieut. John D. Lodge for the Navy.

Because Laboratories' workers are now scattered through many locations in the State of New Jersey, as well as New York City, it was not thought patriotic to consume travel facilities and time to bring them all together for the ceremony of acceptance; but 400 employes, selected by lottery, were present. Lapel emblems, inscribed "a symbol of high service to America," were mailed to more than 5,000 others.

WPB CUTS DOWN USE OF FILM

Allotment of film to motion picture producers will be cut by as much as 24 percent of their 1941 consumption, the War Production Board has announced. The largest users will have to take the heaviest cuts. Smaller users will get up to 90 percent of the 1941 consumption.

There will be no cut in the film allotted for newsreels; for pictures for the armed services; pictures approved by the Bureau of Motion Pictures, as having morale or propaganda value, or for essential scientific purposes or research. Cases of special hardship will be subject to review and reconsideration.

In The

SPOTLIGHT

By **HARRY SHERMAN**

THE Christmas Season approaches and with it comes the joyous expectancy which raises one from the shadowy cold to the soft warm glow of sentimentality. Before us today on the European and African scene there is being enacted the great tragedy of unnecessary bloodshed. Let us all pray for the safe and victorious return of our boys overseas. To one and all I extend my very best wishes for a most enjoyable holiday.

● George W. Lyday, member of Indianapolis Local No. 194, and son of its business agent, Arthur Lyday, was one of the first men to enlist with Uncle Sam's armed forces, back in February 1941. When last heard from, George was in Africa and it is believed he was a member of the Allied forces that recently captured Casablanca.

● Here is a tip, Texans: The Army will open four more motion picture theatres in your state, each one with a seating capacity of over 1,000. One theatre will be located at Matagorda, another at Gainesville, a third at Amarillo, and the fourth will be located at Tarrant Field, near Fort Worth. These theatres will be operated by a civilian outfit, and should employ union men as projectionists. How about it?

● The War Production Board is highly pleased with the copper savings from carbons. according to a report recently made by Chris Dunphy, chief of the amusements section. Mr. Dunphy has completed arrangements whereby the copper collections will be handled hereafter by Walter E. Green, president of the National Theatre Supply Company, and by the executives of the Altec Service Corporation.

● Eddie Stewart, member of Local 306, New York City, is the originator of the plan calling for union projectionists to offer their services gratis in the showing of OCD films. The response to this plan by the membership of the local has been most gratifying.

● The Office of War Information issued a very interesting summary of Japanese broadcasting anent the "defeats" of the United States Navy in its various encounters with the Jap Navy. After the Coral Sea battle, Federal Communications Commission listeners heard the Japanese short wave radio announce, "The Pacific Fleet is annihilated. The United States is reduced to a fourth-rate naval power." After the first battle of the Solomons, Tokio claimed, "Wholesale destruction of the American Fleet . . . Anglo-American naval forces have been reduced to that of a third-rate naval power." According to a recent FCC report, the official Japanese news agency, Domei, has issued the following statement for home consumption: "Again the Japanese Navy has proved its great superiority over the American Navy, which must now be considered a second-rate power." Another "defeat" and our navy will once more be classified as a first-rate naval power.

● Boston Local No. 182 has hit upon a novel plan of taking care of its members and apprentices now serving with the armed forces. A package is sent to each enlisted man every month, and the costs are taken from a fund made up by *voluntary contributions* from the membership, and not from the local treasury. By the way, 182 was the first I. A. local in the country to have a man stationed at each machine in the projection room. If we are not mistaken, this is still a state law in Massachusetts.

● Our technical department has its contest, and we now have one of our own. Can anyone tell us why Eddie (Houston, Texas) Miller's favorite song is "Did You Ever See A Dream Walking?" Also, why did he insist upon patronizing the Brass Rail restaurant during his recent visit to New York, to the exclusion of all other restaurants? One razor blade (sharpness not guaranteed) for the correct answer.

● We understand that Ed Whitford, Syracuse Local No. 376, has a new change-over device that is a knockout. How about sending this magazine some dope on it so that we may pass it along to the rest of the boys?

● Highly complimentary reports have reached us regarding the recent talk given in Pittsburgh, Penna., by Lester Isaac, supervisor of projection for Loew's, Inc. Lester's subject was conservation, and in these trying times there is nothing more important to the industry than the conservation of all theatre equipment.

● It is not the policy of this publication to interfere with local union politics, nor do we wish to advise the officers how to run their locals. This is our reply to the brother who wrote this department regarding an item that recently appeared in these columns about the wage-scale settlement in a certain mid-western city. However, we can advise this brother that the local mentioned DID threaten to strike, and that the members DID receive the increase mentioned in our previous article. If there is any doubt in his mind about the aforementioned statements, he may contact the officials of that local for verification. But when he suggests that we take the matter up with his local union officials, we decline with thanks—*please refer to the first sentence of this item.*

● Despite all the shouting these days about wage freezing, Local 306, New York City, has successfully negotiated new contracts with the motion picture producers for both studio and theatre projection rooms. The new contract calls for a 10% increase, which now makes the wage scale $77 for a four-day week, with double time for Saturdays and holidays; also a relief man one day a week at $19.50 per day. The old contract clause whereby the producer must retain the men on the payroll, even if the projection room closes, still remains in effect.

● Judson D. Beall, member of Local 693, Marlin, Texas, and a first-class electrician in the U. S. Navy, was a visitor to the I. P. offices during his recent five-day furlough. He was accompanied by Eddie Miller (Houston, Tex.) and "Rut" Morris (Mobile, Ala.).

● A talking film on television, prepared for presentation at schools, service clubs, and other audiences which might be interested in iconoscoping, has been made by the General Electric Company, and was recently produced in the form of a 20-minute show over its Schenectady television station, WGRB. This film gives a complete backstage picture of how a television program is arranged and presented. The release of this picture was

held up by the illness of Robert S. Peare, manager of broadcasting for GE, who finally okayed it for presentation over the television station.

● We suggest that hereafter George Donnigan, of Local No. 301, New Britain, Conn., confine his cleaning activities to the projection room of the Embassy Theatre, where he is employed—it is much safer. In trying to clean the chimney of his home, George fell and broke his ankle. George and the ankle are doing nicely.

● Lou Golder, member of Local 253, Rochester, N. Y., and projectionist at the RKO Temple Theatre there, has been made chairman of the Hospital Committee of the Veterans of Foreign Wars for Monroe County.

● One of the exhibitor trade papers carried an article describing the testimonial dinner recently tendered I. A. President Richard Walsh at the St. George Hotel in Brooklyn, N. Y. This article stated that "union police" were scattered throughout the banquet hall, giving the reader the impression that the hall was policed for the protection of the I. A. officers in attendance at the dinner. We have been reliably informed that these so-called "union police" were the regularly hired special policemen found in every hotel that serves the public. The night before the Walsh affair, a dinner was held at the same hotel in honor of a Catholic Bishop, and these same policemen were on duty. Furthermore, we learned that the trade publication mentioned previously sent its photographer to the dinner for the purpose of taking still pictures, but upon learning of his non-union affiliations, he was refused permission to take any pictures. The photographer then appealed to Dick Walsh, who suggested that the matter might be satisfactorily adjusted and asked the photographer to wait for about fifteen minutes. However, before Walsh had a chance to leave the dais, this non-union photographer disregarded Walsh's suggestion and took a number of pictures.

There are many people in this industry who make it a point to embarrass the I. A., and no opportunity to do so is overlooked. Many untruthful and distorted statements regarding the Alliance appear in the various exhibitor publications, and we consider it our duty, as a member of the I. A. to refute these misleading statements whenever we can.

● The first two men in this country to operate motor-driven projectors are Joe E. Robin and Cecil R. Wood, Sr. Cecil, who is chief projectionist at the Astoria, L. I. Studio for the Signal Department, still has his license to prove his claim.

● It was a distinct pleasure to watch Dr. Alfred N. Goldsmith conduct the recent S. M. P. E. Atlantic Coast Section meeting. He is suave, confident, and always has his feet planted firmly on the ground. His keen sense of humor never leaves him, not even when driving home his point. In our opinion, he is tops.

● Ordinarily when a man dons Uncle Sam's khaki it is accepted as a matter of fact. However, the case of Sigmund Clayton, member of the Cleveland Exchange Local is exceptional in that he chose the "hard way" to become a member of our armed forces. Clayton tried to enlist in every branch of the service, but was rejected again and again due to certain physical defects—cross eye and two sets of false teeth. Upon being rejected after numerous attempts to enlist, he appealed direct to President Roosevelt. Ten days later Clayton was inducted in the army and today he is stationed at Camp Perry. We salute you, Sigmund Clayton, you have the makings of a first-class soldier.

● Talk about your coincidences! Dan Cummings, member of the New Haven, Conn. Local, enlisted in the navy and is now serving on the same "battle wagon" he saw service during the first World War. He returned home safely after the last scrap, and we hope Lady Luck will be with him again this time.

● From every section of the country there comes a cry of "labor shortage." Upon investigation we find that where the projection field is concerned it is a cry of "wolf, wolf." Certainly there is a labor shortage, but we maintain that the labor shortage does not affect the projection field. We say that there is a sufficient number of organized projectionists available today to fill all the theatres in the country. Of course, when an exhibitor wants his projectionists to work for peanuts and then cries "labor shortage" when he is turned down, there may be some justification for his complaint. Let him offer his projectionists a decent wage scale and he will quickly find out that the labor shortage in this field is a myth. A well-known trade magazine recently ran an article headed *"See Any Projectionists? Oklahoma Needs Them Badly,"* wherein appears the following assertion supposedly made by a motion picture theatre owner:

> **"The projectionists union deserves a kick in the pants for this situation. Everybody knows they've made a policy of keeping their ranks down to a veritable minimum. The result is that there now are no replacements available because the unions in the past made it impossible for an outsider to learn what it was all about. In one city they wouldn't permit more operators than there was an absolute need for in the houses of that city. I understand this situation is the same everywhere."**

This is typical exhibitor philosophy. It is okay for them to tell the unions to open the doors to all newcomers, but nobody must encroach upon their self-appointed and soft-earning enterprises. Should an honest business man try to build a new theatre in what they consider their exclusive territory, they immediately set up a wail and howl about their self-given "rights." They have their attorneys get injunctions to prevent the completion of the plans for the new theatre on the grounds of overseating, and whatever other excuses they can manufacture. The result usually is that the new theatres in their territories are not built and threatened opposition is removed; in this way they are able to safeguard their own interests. Unions, however, are not supposed to take any measures to protect their members, according to the exhibitors. They advise the unions to open their membership lists to all newcomers,

(Continued on Page 17)

Ceremony at International Projector Corporation plant as Emil Komuves receives citation from Lt. H. Massie Smoot, U.S.N. Left to right: Earl G. Hines, president; John F. Campbell, plant manager; Lt. Smoot, Emil Komuves and Charles Fay, president of Local No. 475, U. E. R. and M. W. of A.

AT YOUR SERVICE

This department is a collection of random thoughts and some not so random; fact, fancy and opinion relating to the man behind the man behind the gun—the serviceman. The prime purpose of this section is to promote a closer relationship between serviceman and projectionist based on a better understanding of their mutual problems through an exchange of news and views, kinks and kicks. To this end, contributions relative to any phase of the serviceman's activities are invited.

SOME success has been had in getting additional service from stock No. 29225 5-ampere Rectigons, removed because of low output. The procedure is simply to re-select the primary taps, giving a higher secondary voltage. The usual history is as follows: When first installed, the bulb is normal in every respect and remains so for a few weeks and then the voltage suddenly drops. The projectionist in order to restore normal operation as quickly as possible installs new Rectigons. This brings the output up to normal and the removed bulb or bulbs are thrown in a scrap pile and marked "N.G." The old tube should be used and will be found normal after the taps have been adjusted.—J. D. STEELY, *RCA, Pittsburgh.*

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Sometimes one has to place a lock washer and nut on the end of a screw in a difficultly accessible place, one so out of sight that the screw tip can only be touched with the end of the finger. Here's an easy how. First insert a match stick or a short bare wire into the hole, sufficiently far that the lock washer and nut can be easily threaded onto same. Then push the matchstick or wire out with the index finger tip and as the wire leaves the finger clamp the lock washer and nut right over the hole. The screw is then inserted with the other hand and readily started. With a little practice this can be done very rapidly.—A. F. SCHNEIDER, *RCA, Kansas City.*

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The new 1-kw. type Simplex or Strong lamp is made for use with 12" positive carbons only. If a 14" carbon is used, it is very likely to hit the dowser unless it is burned in or broken off slightly. In order to use 14" carbons safely, one can modify the lamp as follows: Remove the large locating stud at top of reflector mounting assembly. This holds the mirror assembly rigidly to top of lamp house. The assembly is then moved back toward rear of lamp house until sufficient space for a 14" carbon is obtained. Rather than drill and tap a new large hole in top of lamp house, merely drill and tap both lower rails to take a 10/32 screw. With reflector mounting squared off and against top of lamp house, tighten up the two 10/32 screws to bear against base of reflector mounting assembly and thereby lock it into place. The entire lamp house is then moved forward on the pedestal to compensate for moving center of focus back from original position. I believe it is more economical to use 14" positive trim than the 12" and this modification will allow its use in these lamps.—E. D. VAN DUYNE, *RCA, Philadelphia.*

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Place elbow on the wall in front of the projector. Reach out and touch the projector very lightly. If there is a "lope" in the machine, it is certain to jam within a few days. Correct the cause of the "lope" and the machine will be normal again with no possibility of jamming. This not only saves projector parts but it also saves the whole drive assembly in most cases. — C. W. STELLING, *RCA, Atlanta.*

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Emergency calls and sound outages resulting from drive motor failures can be greatly reduced by acquainting the projectionist with two simple emergency measures. Motor failures usually fall in one of two categories: (1) The motor hums when turned on but will not start. (2) The motor runs but overheats, smoke appearing after a few seconds of operation. Both of these conditions are ordinarily a result of faulty action of the centrifugal starting switch. In the first instance the switch does not make contact; hence, no current flows to the starting winding. The remedy is to turn the motor on and start the projector by hand. If the crank can be used, this is the easiest method. In many cases a crank cannot be used, in which event hand-starting must be resorted to. On self-driven soundheads, the flywheel can be turned by hand until the motor takes hold. On stabilizer types of soundheads, the framing wheel can be used. Some machines start easily when the framing wheel is given a spin by hand. On others it may be necessary to wrap a few turns of flat belting around the framing wheel so that the wheel can be spun by pulling on the free end of the belt as in spinning a top. In any method of hand-starting, be sure that the start is in the proper direction of rotation or the motor may run backwards.

The second type of motor failure, where over-heating and smoking occurs, is considerably more serious since continued operation will result in a complete and permanent failure of the motor. This condition is caused by failure of the centrifugal starting switch contact to open after the motor has come up to speed. Emergency procedure in this case is as follows: Disconnect the starting winding by removing or breaking the circuit No. 2 (marked on the brass band in most motors), at the starting box. On rotary stabilizer type of soundheads, this lead connects to the upper left-hand terminal of the manually-operated starting switch either directly or through a starting resistor (in which latter case the circuit is broken by removing the lead running from the upper lefthand terminal to the starting position). Having disconnected the starting winding in this manner, it is a very simple matter to start the motor by holding the disconnected lead momentarily in contact with the terminal from which it was removed while operating the manual starting switch in the usual way. As soon as the motor comes up to speed, take the lead off the terminal. (Upper left-hand terminal of manual starting switch.) The motor will continue to run and no damage to starting winding can result since the starting circuit is now open.—J. E. STEELY, *RCA, Pittsburgh.*

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The newer type flashlight made with a lucite rod that will transmit light from one end of a pretzel to the other certainly is a handy tool. It puts the light right on the sprocket teeth, rollers, inside corners, and those little out-of-the-way places that can cause so much trouble.—R. H. HECHT, *RCA, Chicago.*

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With the sudden changing of power load due to war industry, etc., grounding in neutrals should be checked in cases of a new hum from the system. In one case, I found a potential of 18 volts from the booth conduit to the system ground and by separating the two, cured an obstinate case of 120-cycle hum.—L. P. WORK. *RCA, Cleveland.*

Craft Maintains High Standard of Ingenious Contest Solutions

THE FAMOUS old American traditions of ingenuity and resourcefulness are certainly not dead so far as projectionists are concerned. Answers to the October contest fully maintained the high standard set by I.P.'s readers in September. Again a problem was presented that was tough and far out of the ordinary — and again a volume of highly ingenious solutions, thoroughly practical in an emergency, came in from all parts of the United States and from Canada.

Many of the contestants, moreover, were not satisfied merely to have licked a tough problem. They went behind the problem to its cause, specifying steps to be taken to prevent a recurrence of the condition. Second prize winner George O'Brien, for example, devotes several paragraphs of his letter to the details he would investigate—after repairing the stripped gear.

Solutions presented fell into several definite groups. One was the suggestion that the stripped gear be repaired in a nearby machine shop or garage. A number of readers went into a good deal of detail as to just what the machine shop must do and how it should go about doing it. But others see in the local machine shop only one possibility out of many, and proceed to name alternate solutions. Thus, first prize winner H. D. Taylor, after offering this suggestion, goes on to point out that "machine shops capable of doing this kind of work are subject to be several days behind in emergency repairs . . . or available repair shops may not have the equipment for cutting gear teeth." Taylor then describes other resources. In other words, Taylor, and a number of contestants, submit not only one answer to this tough problem, but several.

Another group of readers, and a large one, suggests the use of taper pins, screws or bolts, to be driven into the stripped portion of the gear in the proper places and suitably filed to take the place, temporarily, of gear teeth. This is a device normally used to effect very temporary gear repairs in some industries.

Other readers recommend searching the scrap box—including scrap boxes of neighboring theatres if necessary — to find a damaged gear of the same type, from which a section can be cut to replace the stripped portion of the gear to be repaired. Still others specify brazing or welding new material to the damaged gear, and then cutting and filing new teeth in the projection room; in which case, of course—as with the use of taper pins—results will not be perfect, but if the work is done carefully enough, the show can go on.

Some contestants, unfortunately, failed to specify the make and model of their mechanisms. This was of no importance in connection with some solutions offered. But there were some solutions submitted that will not work with all mechanisms, and when the contestant failed to specify the make and model of his own equipment there was no way to tell whether the proposed remedy was sound or not.

As in the case of the September contest, selecting the winners was not easy; and the decision as to which contestants were to be awarded subscriptions rather than honorable mention were in some instances particularly difficult. Prolonged reading and re-reading of the answers did not always help, and in the end some contestants had to be voted to the Honorable Mention column by the difference of a split hair.

First prize winner H. D. Taylor begins by identifying his equipment, and goes on to say:

"If one-quarter of the drive gear surface (22 teeth) is stripped, it will be the outer gear surface, which engages the pinion drive and the intermediate gear. This repair job can best be done in a machine shop by milling the stripped surface deep enough so that new metal can be pinned or welded into place and new teeth cut."

Taylor then questions whether the machine shops in his vicinity that are equipped to cut gear teeth will be free.

(Continued on page 20)

Contest in Wartime Projection
A Test of Skill and Wits

KNOWLEDGE of projection, skill, and resourcefulness in meeting unusual conditions arising out of the war feature this novel contest, which is open to all practicing projectionists. Fancy writing, skill of presentation, win no prizes; prizes are awarded solely on the basis of how well the contestant has met the problem presented. The editorial staff of I.P. are the sole judges, and their decisions are final.

The following prizes are offered *each month*:

First Prize . . . . ***$10.00*** **in War Stamps**
Second and Third Prizes . . . . ***$5.00*** **in War Stamps**
Next Six Best Answers. .One Year's Paid-up Subscription to I.P.

Additionally, at the end of the contest, there will be awarded for the most consistent showing a

Grand Prize . . . . ***A $25.00*** **War Bond**

All answers much reach this office by the tenth day of the month following publication of the question: that is, all answers to December's question, published below, must reach I.P. by January 10.

Here is the question for December:

Your volume control breaks down, creating so much noise the sound cannot be heard. You find it beyond repair. There is no other volume control in your system. Because of war conditions, you cannot get a new one for some weeks. What do you do?

Apply this question to your own equipment, your own projection room. It's your problem, you have to solve it; there'll be no show till it's solved.

For the most ingenious and *practical* solution you win $10.00 in war stamps and a running start toward the Grand Prize $25.00 war bond.

Novel Method Conserves Carbon Stubs

By **AUGUST PATTERSON**

MEMBER, L.U. 364, AKRON, OHIO

IN THESE times, when all projectionists have been called upon to help conserve copper, I have a very practical method of taking the guess-work out of burning carbons to 1-inch stubs. I would like to pass it on to any fellow projectionist who cares to adopt it. Briefly, the method consists of a graph which is made by the projectionist himself. It is very easy to make, and even easier to use.

To use this graph, simply place one end of the unburned stub on line AB and slide the stub up or down until the other end crosses line XY. Then on line AB read the running time for that stub.

I am using a graph of this type with the new Victory carbons, and am able to burn my stubs to 1/10th inch without worrying whether I have enough carbon to run the reel.

Separate graphs can be made for positive and negative carbons. On each graph, the carbon consumption in inches *at a specified amperage* is plotted against the running time of the reel of film in minutes.

For example: suppose that at 45 amperes, a 7 mm Suprex positive is consumed at a rate of 4 inches per 20 minutes. Obviously 2 inches of carbon will burn in 10 minutes; 1 inch in 5 minutes.

Now look at the graph: line AB indicates the running time of our reel in minutes; line CD is the amount of carbon actually consumed and line XY shows the amount of carbon needed to run the reel with a carbon saver.

To make this graph, draw line AB, preferably on ruled paper, and at regular intervals mark off the time in minutes. Finding line CD is very easy. Opposite the 20-minute mark, place point F, at the exact distance in inches from line AB as the amount of carbon consumed in 20 minutes (in our present example, 4 inches). Opposite the 5-minute mark place point E, the exact distance in inches from line AB as the amount of carbon consumed in 5 minutes. Through these two points draw line CD.

Since a 1-inch stub must be left, line XY is drawn 1 inch to the right of line CD and exactly parallel to it. The burning time of the carbon has nothing to do with the location of line XY. The burning time of the carbon governs the location of line CD, as already explained. But if a 1-inch stub is desired, line XY is placed 1 inch beyond line CD; if a 2-inch stub were needed line XY would be placed 2 inches beyond line CD, and so on.

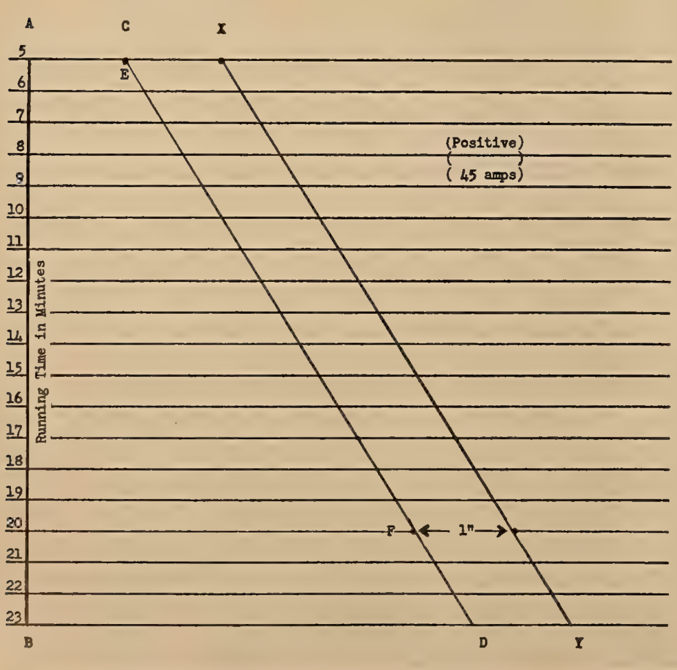
The graph is now ready for use. To use it, as already stated, simply place one end of the positive or negative stub (whichever the graph is for) on line AB, and slide the stub up or down until its other end just touches line XY. The figure on line AB alongside the stub will be the running time that stub allows.

In using this graph:

First: Don't guess at the running time of a reel of film. Measure it.

Second: Be sure the arc amperage does not vary from that for which the graph was made.

Third: Avoid using cracked, wet or otherwise imperfect carbons. These will increase the amperage and the rate of carbon consumption.



Graph for measuring burning time of carbon stub.

Gnawing At America's Productive Power

By **PAUL DE KRUIF**

THIS year bids fair to find our vaunted national conquest of tuberculosis at a standstill for the first time since World War I. The sinister sickness is beginning to flame high again. It gnaws at the vitals of America's productive power. It kills more and more Americans under the new strain of work in defense of our nation's life. The year 1940 saw an upsurge of the TB death rate in many of our leading cities. What may happen if we relax our war against this form of mass murder is shown by ominous warnings from across the ocean. In 1939, England, Wales, and Scotland were pretty well satisfied with only 29,000 annual deaths. Then came *their* strain of all-out war production effort. The white plague's toll, 1941, was well up in the 30,000's on that embattled island.

Here's the exquisite manner in which the white death pounces first of all on those under strain of the fight for national existence—it's shown by the fact that against tuberculosis the efforts of our British cousins have failed. This is one sickness where deaths show an upsurge. Even deaths by bombing have been curbed. England is a healthier nation than it was before the war began, in spite of all its dislocations and deprivations healthier — excepting for tuberculosis.

That the strain of war production does not itself mean the inevitable return of the white plague, is proved by the brilliant success of Detroit's fight against it. In that city, long before Pearl Harbor, the strain of industrial production against the world's would-be destroyers was already intense and terrible. In Detroit the conditions of life are lovely—for the TB microbe. Yet here the curve of the white death is going steadily downward, in spite of housing conditions that are infamous, that are not fit for dogs, much less humans. Detroit has driven its death rate almost down to that of the nation.

If Detroit had any special—if not secret—weapon at all, that weapon was money for the death fight.

It is the money, given so ungrudgingly

by millions of Americans, since 1907, to the Christmas Seal Campaign of the National Tuberculosis Association, that has been the most powerful single factor in our half-successful fight against the white terror.

This year, with the grim need for us to keep our men on the industrial front in top physical condition, and with their peril from tuberculosis greater because of the strain under which they work, it is especially important that all of us do our utmost, buying Christmas Seals with every spare nickel, dime and dollar.

IN THE SPOTLIGHT

(*Continued from page* 13)

thereby creating an overflow of manpower. The next step would be the reduction of salaries—projectionists salaries, we mean. We hope the unions won't fall for that line—once is a mistake, but twice is inexcusable.

Although almost every local in the I. A. is represented in our armed forces, there are still enough men left to fill all available jobs. We are not speaking of a local that has only eight members, three of whom have enlisted. In such a situation the remaining five members could double up on the jobs, or get replacements from the nearest sister local. For instance, Local 306 with a membership of over 2100 has at the present time an unemployed list of over 125 members. There are many other local unions in the same predicament—naturally, where the membership list is smaller, the number of unemployed members is also relatively smaller. The cry of "shortage" in this field must be hooted down. Yes, there is a shortage of theatre employees—ushers, cashiers, and managers. These people are leaving their theatre jobs to get employment in war industry plants where they can earn a decent living wage. In some theatres ushers are paid the munificent sum of 27c an hour, based on 15-minute intervals. This undoubetedly is how some exhibitors would like to treat their projectionists, if the unions would permit them to get away with it.

Since most of the projectionists are over 45, married and have families, they are draft exempt—so what is all this yelling about anyway?

● Warning to I. P. readers: We have been informed that there are certain people traveling about the country representing themselves to be subscription agents for this publication. Such persons are IMPOSTERS, for we employ no subscription solicitors and anybody subscribing to this magazine through one of these so-called agents does so at his own risk. Subscriptions to I. P. should be sent direct to this office, either by the subscriber himself or through his local union.

● Father Time has finally caught up with Abe Kessler, one of the oldest members of New York City Local 306. For many years Abe was the pivotal point of the Sick and Distress Committee, which is headed by "Chubby" Rosenberg. Old man illness grabbed Abe for a spell this fall, forcing him to resign all positions, but you can bet your shirt he will soon be in action again working his head off for the boys of the local.

● John H. Rugge, who was re-elected president of Local 702, New York City, for the sixth time, and is now a lieutenant in the U. S. Army, has been transferred from Camp Crowder, Mo., to Ft. Sam Houston, San Antonio, Tex. John Francavilla, vice-president of the local, will carry on in Rugge's absence.

● In addition to purchasing more than $10,000 worth of war bonds, the members of Local 521, Long Beach, Calif., voted unanimously to adopt the AFL-US Treasury Department 10% payroll deduction plan, according to a recent announcement by Alonzo Bennett, secretary-treasurer of the union.

(*Continued on page* 19)

BUY U. S. WAR BONDS

THE MAIL BOX

To the Editor of I.P.

I was very surprised and pleased to receive $5.00 worth of War Stamps as a result of entering the I.P. Contest. Many thanks.

I am continuing in the Contest—mailed an entry in the November Contest two days ago—but if I don't win any other prize I shall most certainly have gained from the Contest for I have been sort of losing interest in keeping up with things lately. The contests have given me new interest.

I think it is a fine thing and I am looking forward to learning a lot of things in the next few months, not only from the answers of other projectionists in I.P., but by the necessity of digging into things to enable me to enter the Contest.

Again, thanks.

Yours truly,
MAURICE RUSHWORTH,
Chief, "NEW" Theatre,
Baltimore, Md.
Sec. Local 181, *I.A.*

TELEPHONE COMPANY DEVELOPS TUBE-LESS AMPLIFIER

Further development of small sound amplifiers using no tubes is announced in the October, 1942, issue of the Bell Laboratories Record. These low-power, tube-less amplifiers have been designed in connection with hearing aid equipment. The latest development fits inside a standard telephone and is intended to provide increased volume for the benefit of telephone users suffering from hearing impairments.

A basic advantage of the tube-less amplifier lies in the simplicity of its power supply requirements. The telephone device just developed needs only a 4½-volt "C" battery. The entire amplifier is smaller in size than one of the metal hemispheres of a telephone bell. It produces a gain of 25 db.

Tube-less amplifiers consist essentially of a telephone receiver mechanism acting directly (mechanically) on a telephone microphone, or transmitter. The electrical output of the microphone is an amplified facsimile of the electrical input to the receiver; the only additional power needed being supplied by the 4½ volt microphone battery. This form of amplifier is older than the vacuum tube; having been originally invented for long distance telephony and supplanted for that purpose when the vacuum tube made its appearance. It now appears to be staging a come-back and supplanting the vacuum tube, though only in low-power work up to the present time.

DU MONT TELEVISION ON DISPLAY

Members of the American Television Society viewed and operated apparatus of the Du Mont Television Company at the company's studios on November 24th. Following a lecture and demonstration, the society's members were encouraged to handle the equipment themselves, to experiment with the use of the television camera, and otherwise familiarize themselves with practical operating details.

IN THE SPOTLIGHT

(*Continued from page* 17)

● One of our readers sent us an article clipped from a trade publication that tells of a theatre owner in Moreland, Okla., who placed his fifteen year old son in charge of the projection room of his theatre. What responsibility to place in the hands of a youngster, and what a chance the theatre owner is taking with the safety of his patrons! Legal steps should be taken to prevent this sort of thing—the sooner, the better for all concerned.

● Camden, N. J. Local No. 418 reports the death of William R. Bowen, Sr., one of its trustees. Bowen was employed as a projectionist at the Warners Princess Theatre, and his passing was a shock to his fellow-workers.

● The boys from St. Catherines, Ont., Canada, presented Charlie Dentelbeck, supervisor of projection for the Famous Players Canadian Circuit, with a "V" (for victory) sign made from carbon savings. Dentelbeck will turn this gift over to the scrap drive.

● Letters and more letters—cheerful letters—letters mentioning familiar names and places—are what our boys in the armed forces want. Many of these boys are hundreds and thousands of miles away from their homes and families, and a letter from home is eagerly awaited. Let's get to work and make it a practice to do our share in keeping up their morale by writing to them as often as we can.

SERVICES RATE MOVIES HIGH, LETTER TO DE VRY SHOWS

So important do the Services consider motion picture entertainment at the fighting fronts that 9 De Vry incandescent projection lamps were recently rushed to a Naval officer in the Pacific by an Army Ferry Command bomber.

The officer, Lieut.-Commander H. P. Michiels, wrote to E. B. DeVry explaining that he had had the lamps on order through official channels for four months, but for some reason had not received them.

"Out here on the Pacific movies are the one and only diversion our boys have apart from chasing Japs, so if you'll be good enough to send me a half dozen of those projection lamps, it will really be the biggest favor anyone could do for our crew," Commander Michiels wrote.

Within half an hour of its receipt, the letter and 9 lamps for a DeVry "XD" projector were on their way to the Navy Department in Chicago. Naval officers who read the letter immediately contacted the Army Ferry Command, and that same afternoon the lamps were being flown westward toward their destination.

BUY ● WAR ● BONDS

I.P. CONTEST

(Continued from Page 15)

when such an occasion arises, to do the work promptly. If they are not, then, "in order to prevent running on one projector for several days, other repairs will have to be attempted."

He continues:

"I would attempt to repair the gear by carefully center-punching each stripped tooth and drilling a hole approximately 1/16th inch in diameter, staggering the holes from tooth to tooth to preserve maximum walls between holes for strength. Pins carefully fitted and slightly tapered can then be driven into the holes tightly, then carefully trimmed and shaped with suitable files to form teeth that should last through the emergency, with proper care and attention. It would be advisable to take as much starting strain off the emergency teeth as possible by turning the projector over until the pinion drive gear disengages the emergency teeth."

Taylor then discusses another possible solution, involving changing the gearing and threading of his projector, which would work if the damaged gear happened to have been stripped in certain specified ways.

George O'Brien, second prize winner, would first canvass all theatres in the neighborhood in an effort to borrow a spare gear or a spare head. Failing this, he would try to borrow a similar gear that had been similarly stripped, and have a local machine shop take one good section from each gear and weld those sections together.

Failing that, he would have the machine shop proceed as per Taylor's first suggestion.

O'Brien next lists a number of possible causes for the trouble, all of which he would check on "before inserting the repaired main drive gear" — to avoid stripping it a second time.

Fred A. Erhard, third prize winner, recounts that the "tragic experience" of a stripped main drive gear happened to him at 1:30 P.M. of a Saturday, meaning that he would have to run through the weekend with one projector unless he could effect repairs. Erhard prescribes considerable detail, based on that experience, how to saw out the damaged portion of the gear, how to select and saw out a precisely corresponding section from the good part of another stripped gear. He continues:

"Now all you have to do is to clamp those good parts to a piece of perfectly flat metal, using your G-134-G gear and the lower sprocket gear as gauges to make sure that they all mesh properly; clamp the parts down solidly, take them to a Union Welder A. F. of L. and have him braze them together."

Erhard reports that in his own case "the idea worked swell. In fact, it worked so well that when I got the new gear I kept it for a spare and used the patched gear for nearly two years."

But of course, stripped gears may not always be so easy to find in these days of scrap collections.

William Dugard, subscription winner, offers the alternate suggestions of brazing new metal onto the gear and filing new teeth in it; or drilling holes in the stripped portion and driving in pins which are then filed to shape. He does not go into as much detail on these remedies as did the contestants previously referred to as having offered them.

Instead of pins, subscription winner McGillivray suggests machine screws to be subsequently filed down "to the approximate shape of good teeth."

Subscription winner Ridgwell, in a similar emergency, used a local machine shop to drill the teeth and insert and file the pins. "In using the gear, I was very careful that the makeshift teeth wouldn't be brought into play until 112-G had made a complete turn. . . . The thing worked nicely."

Subscription winner Rushworth would drill holes in the stripped portion of the gear and drive in sawed-off stove bolts with heads 5/16th inch diameter, as close together as possible. The screwdriver slots would thus be 5/16 inch apart, and resemble the slots between gear teeth—"one slot where two were before." Rushworth would then go to work on the stove bolt heads and their screwdriver slots with grindstone, hacksaw and file. As a second suggestion Rushworth proposes to take the stripped gear to a machine shop to "build up the metal, or weld a strip in, then cut teeth."

Subscription winner Schmitz has "the good fortune of having a friend who runs a machine shop that I can use." He also would cut a good section from a second stripped gear, but instead of welding

Winners of the October Contest

1st Prize
H. D. Taylor
1516 Greenwood Street
Raleigh, N. C.

2nd Prize
George O'Brien
69 Central Ave., N.
Fort Erie, Ont.

3rd Prize
Fred A. Erhard
P.O. Box 1130
El Paso, Texas

Winners of One-Year Subscriptions to I.P.

William R. Dugard
4670 Josephine Street
Denver, Colo.

C. McGillivray
1911 Walcott Way
Los Angeles, Calif.

Ray Ridgwell
79 Cumberland Avenue
Portland, Me.

Maurice Rushworth
531 South Longwood Street
Baltimore, Md.

William J. Schmitz
61 Oakdale Boulevard
Pleasant Ridge, Mich.

Martin Teker
Sheridan, Mont.

Honorable Mention
B. N. Alsbrook
El Campo, Texas

George J. Beltz
33 Ninth Street
McMechen, W. Va.

Charles Erickson
219 Addison Road
Glastonbury, Conn.

Charles M. Butler
217 East 88th Street
New York City

Paul Cummings
Douglas, Wyo.

Earl H. Griffen
390 Varney Street
Manchester, N. H.

Ed. Howson
Box 329
Watertown, S. Dak.

Chester P. Jenness
58 Temple Street
Nashua, N. H.

R. J. Mellien
Newark, Ohio

Carl F. Patterson
108 Tulare Road
Kenmore, N. Y.

J. Wallis Rainwater
Anniston, Ala.

Oscar H. Smidt
P.O. Box 82
Kankakee, Ill.

Edward M. Sharzer
632 Harvard Street
Mattapan, Mass.

it in place, as Erhard had done, would pin it in place. Schmitz' letter, a very close runner-up for one of the war stamp prizes, goes into considerable mechanical detail, and adds:

"The consolation that one will get after this is all done and running, is to hear the boss yell when he has to pay the overtime."

This contestant also notes that "the first thing to do if there is a bindup is to find the cause and remove it. After the gear has been repaired and replaced in the mechanism, before turning on the motor switch the head should be turned by hand so as to bring the good part of the gear in starting position, to avoid strain on repaired part."

Subscription winner Teker reports that he also has repaired a stripped gear by drilling holes in the damaged part, driving in metal pins and filing them to shape. He keeps that pinned gear on hand in case of another emergency.

I.P. regrets that space does not permit quotation from the many other answers received, some of which, as has been noted, are extremely similar to those to which prizes were awarded.

PROJECTION IN THE ARMY

(*Continued from Page* 10)

set up interference in some locations. This last may be cured, Bub said, by the use of condensers and radio-frequency choke coils at the source of the pickup in the sound system.

Bub went on to point out that "various grounds have various potentials depending on the size and length of grounding wire, resistance of points in conduits and water-pipe, type of soil, dampness and acidity and depth of grounding coil or length of ground rod." To avoid ground loop currents resulting from the fact that two grounds are at different potentials, the Service specifies independent ground wires for equipment circuits and signal circuits.

Murray, who spoke after Bub, warmly praised the Army projectionists, pointing out that film damaged by fire during the last year totalled only 83,000 feet out of more than a billion and a half feet run, or 51/10,000ths of one percent. This record was achieved, the Director of the Service noted, in spite of the fact that the turn-over in the volunteer force of projectionists is "tremendous," and that "the majority of them never saw a projector before they entered the armed forces."

ALTEC SERVES NAVY NOW

Altec Service Corporation is now under contract to manufacture and install a highly secret electronic war device used by the U. S. Navy, according to an announcement issued by the corporation's headquarters in New York.

The nature of the device is not disclosed, aside from the fact that it is new, complicated, and operates on electronic principles. Altec is setting up a factory at Lexington, Mass., where the contrivances will be manufactured and tested.

In addition to making and installing the secret devices, Altec will set up a nation-wide program for instructing Naval personnel in their use.

U. S. CIVIL SERVICE WANTS PROJECTIONISTS

The United States Civil Service wants projectionists, sound technicians and other motion picture experts, and will pay from $1,440 to $3,800 a year. Positions are open throughout the United States, its territories and possessions. Projectionists are particularly wanted by those Federal agencies which are making instructional films for service men and civilians on war jobs, and films recording the history of the war. Application blanks, and full information, will be sent to any inquirer by the U. S. Civil Service Commission, Washington, D. C.

NATIONAL THEATRE SUPPLY COMPANY *INCORPORATED*

NINETY-TWO GOLD STREET • NEW YORK

FROM THE DISTRIBUTORS OF Simplex PROJECTORS REGARDING Simplex SERVICE

November 19, 1942

TO THEATRE OWNERS, MANAGERS AND PROJECTIONISTS

No one can deny that the present disturbing conditions give us all a deep sense of obligation to one another, and a very heavy obligation is felt by us to the exhibitors of the country.

We shall never forget the support that theatre owners have given us and so I say emphatically that, within the limitations created by war demands, we shall continue to give Simplex Service to the very best of our ability, as we have for so many years.

We have all heard the old saying that, "The Show Must Go On", and I think you will agree that the manufacturers and suppliers of theatre equipment have pretty generally seen to it that the show did go on.

Now, while it is true that our intentions are still the same as they were, it must be realized that our physical ability to carry out these intentions has been greatly reduced.

Today, of course, there is a vast difference between wants and needs. In our judgment, wants are out for the duration. On the other hand, it looks as if the needs will be provided for.

Every exhibitor can do his part and help in keeping his show going by seeing to it that as far as possible he plans for his equipment needs in advance.

The service, the equipment or the replacement part an exhibitor needs can, in all probability, be made available provided time is allowed to get this material to the theatre.

Right here is where cooperation and a willingness to understand and work together harmoniously, not for business as usual, but essentially in order to keep going, will benefit every theatre owner in the country.

Very truly yours,
NATIONAL THEATRE SUPPLY COMPANY

Walter Green

President

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

WEG:jh

BRANCHES IN ALL PRINCIPAL CITIES

NATIONAL THEATRE SUPPLY COMPANY

COMPLETE SOUND AND VISUAL PROJECTION EQUIPMENT

Simplex

INTERNATIONAL PROJECTOR CORPORATION